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Technical reports for the Ruby A Federal No. 1-9 exploratory oil/gas well

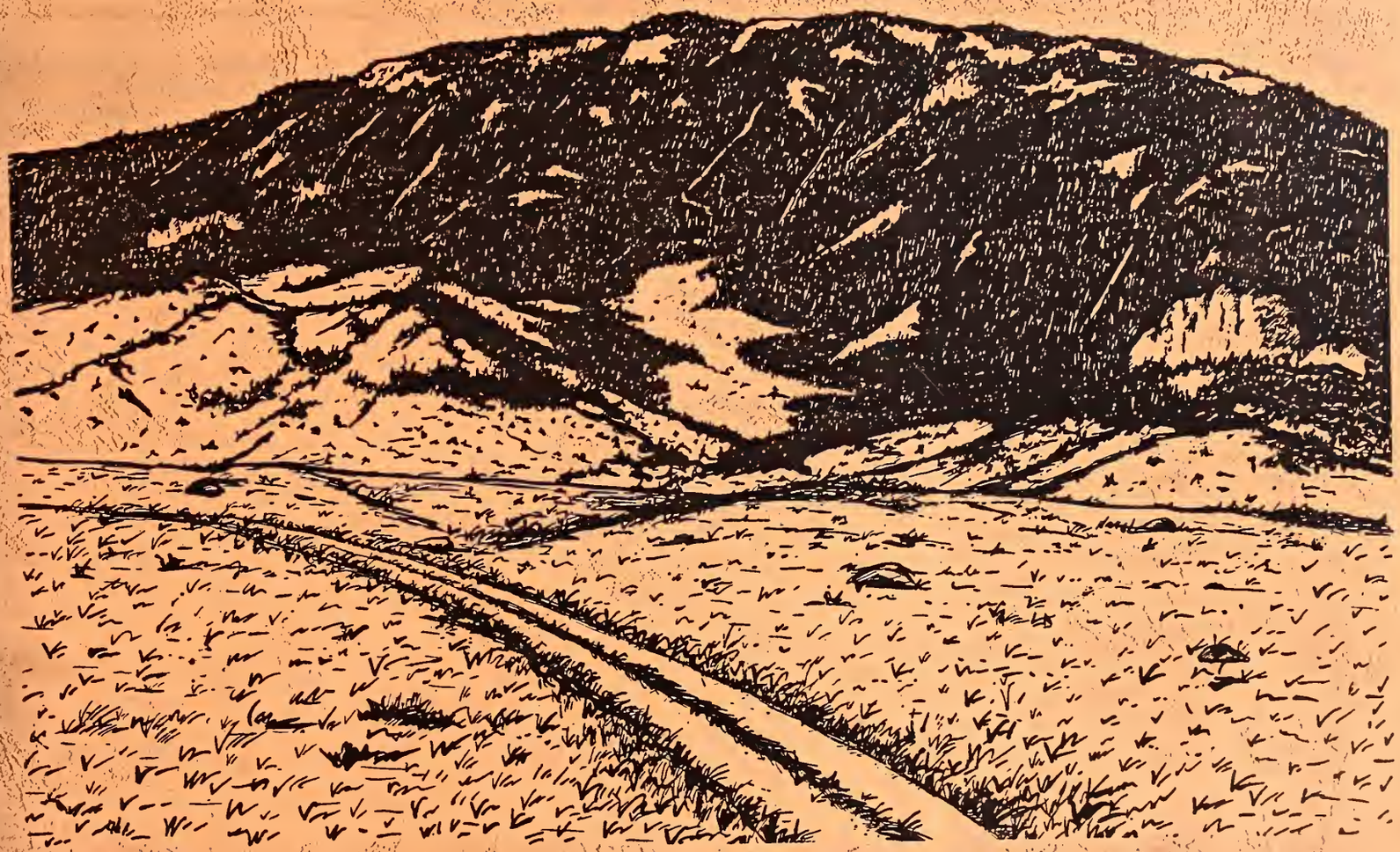
ICAL REPORTS

FOR THE

Ruby A Federal No. 1-9
Exploratory Oil/Gas Well

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Proposed Oil and Gas Drilling
Near Red Lodge, Carbon County, Montana



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TECHNICAL REPORTS

FOR THE

Ruby A Federal No. 1-9
Exploratory Oil/Gas Well

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Prepared By

U.S. Department of Agriculture
Forest Service
Custer National Forest

U.S. Department of the Interior
Bureau of Land Management
Miles City District

Gary Holsan Environmental Planning

May 1989

RUBY A FEDERAL No. 1-9 EXPLORATORY OIL/GAS WELL

ENVIRONMENTAL IMPACT STATEMENT

SUPPORTIVE TECHNICAL REPORTS

The following Resource Technical Reports were prepared during the environmental analysis of Phillips Petroleum Company's proposed exploratory oil/gas well near Red Lodge, Montana. The reports are meant to provide additional information to interested readers of the Draft and Final Environmental Impact Statements (Draft EIS May 1989 and Final EIS anticipated August 1989).

The technical reports comprise the primary source of information used in conducting the EIS analysis. They contain general and specific information regarding the natural, or social resources within the existing environment and the potential impacts that could occur from activities associated with this proposed development.

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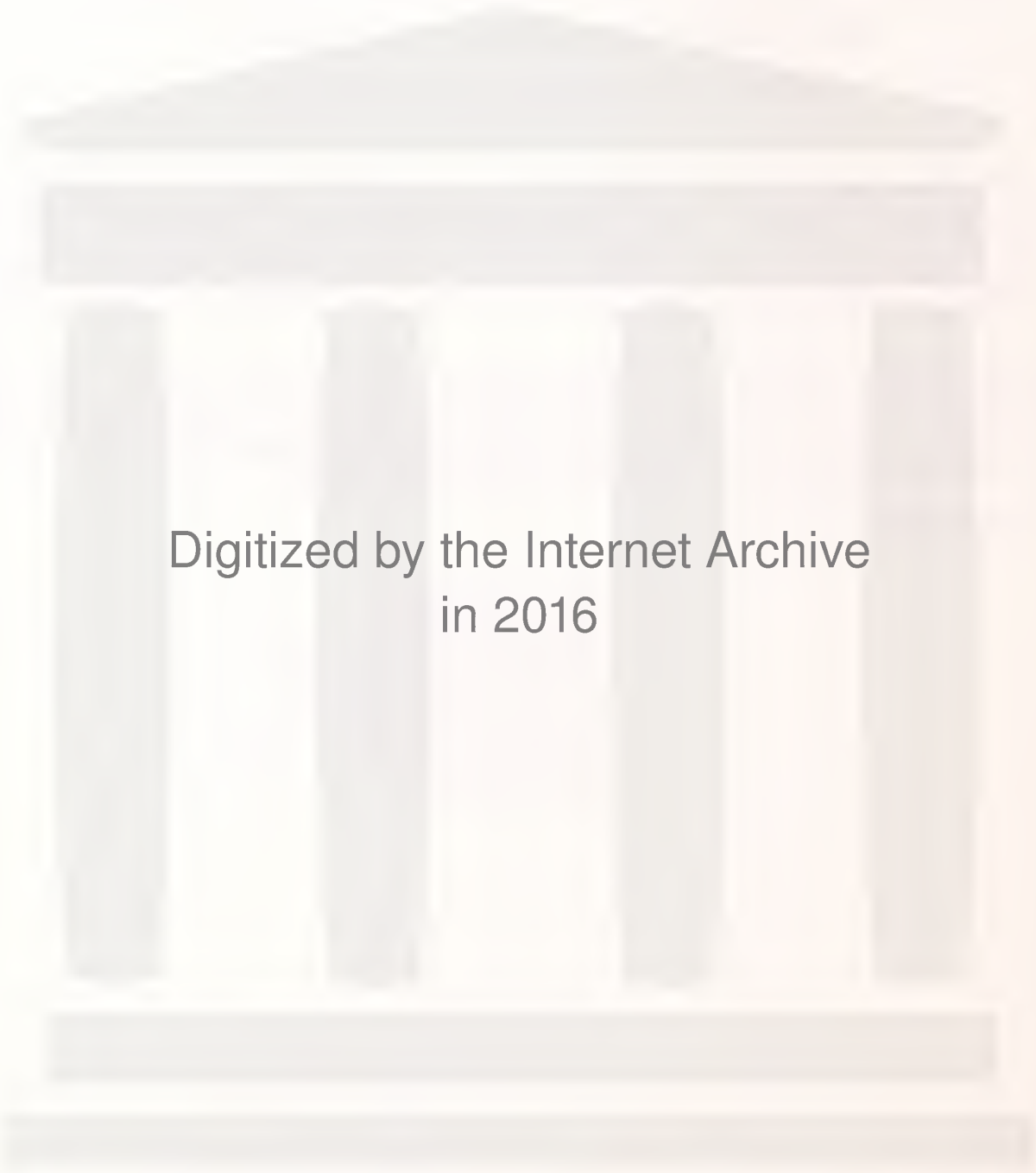
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TECHNICAL REPORTS:

A - Soil Resources

B - Water Resources

C - Vegetation Resources

D - Wildlife Resources

E - Visual Resources

F - Recreation

G - Socioeconomics

H - Engineering

SOIL RESOURCES

SOIL RESOURCES TECHNICAL REPORT

Prepared For The

Ruby A Federal No. 1-9 Exploratory Oil/Gas Well Project

Phillips Petroleum Company
152 North Durbin, Second Floor
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December 1988

SOIL RESOURCES TECHNICAL REPORT

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SOIL RESOURCES TECHNICAL REPORT

INTRODUCTION

The following technical report provides site-specific information on the geological and soils environment of the Phillips Petroleum Company's proposed Ruby A Federal No. 1-9 Exploratory Oil/Gas Well project, an analysis of the potential impacts that could occur if the project were implemented, as well as mitigation measures recommended to reduce adverse impacts. The GEOLOGY/SOILS Sections of the Draft Environmental Impact Statement were prepared based on this information.

Alternative A (Proposed Action) - Ruby Creek Drill Site and Access Route

Phillips proposes to directionally drill a 12,520-foot exploratory oil/gas well on the Beartooth Ranger District, Custer National Forest, Carbon County, Montana. The drilling proposal is located in the Ruby Creek drainage, a tributary to the Clarks Fork of the Yellowstone River. The drill site is located in the NW1/4 NW1/4 Sec 15, T9S, R20E. Access to the proposed site would utilize 4.3 miles of Montana State Highway 72 south from Belfry, Montana, to Grove Creek Road, an existing improved county road. From this point, access would head west towards the drill site, utilizing 5.0 miles of Grove Creek Road and approximately 8.0 miles of existing unimproved "two-track" roads to the Custer National Forest boundary (Forest boundary).

Access to the Forest boundary would traverse BLM-administered land and land under private ownership. From the Forest boundary, access would utilize approximately 0.8 miles of unimproved two-track road to its terminus. To reach the drill site from this point would require approximately 0.3 miles of new road construction. Phillips proposes to construct a 1.7-acre drill pad. Disturbance associated with this alternative would include 21.3 acres of existing road reconstruction (two-track), 1.5 acres of new road construction, a 1.7-acre drill pad, and 0.8 acres of cut and fill slopes and topsoil stockpile associated with the drill site. Total disturbance would be 25.3 acres.

Alternative A Access Route Variations

To assist in the FS and BLM decision-making process, three access route variations to the proposed drill site (Alternative A) were considered in the analysis of this alternative. The purpose of the analysis is to provide a contrast in management opportunities and environmental impacts that would assist the agencies in the decision-making process. These variations are summarized in the following sections.

Proposed Action (Variation A1)

This variation is Phillips' proposed access route to the Ruby Creek drill site described previously.

Meeteetse Trail - Robertson Draw Access Route (Variation A2)

The Meeteetse Trail - Robertson Draw Access Route variation follows the county improved Grove Creek Road to its terminus for 5.0 miles from Montana Highway 72. From the end of the Grove Creek Road, this access route follows unimproved two-track roads for approximately 1.1 miles to the Meeteetse Trail road and then follows this

road for approximately 5.1 miles to its convergence with the Robertson Draw Road. From this point the access route follows the Robertson Draw Road for 5.7 miles to a point where an unimproved two-track road heads north toward Mill Draw. The access route follows this two-track road to Mill Draw where it converges with Phillips' proposed access route. From this point, this access route variation is identical to Phillips' proposed access route. This variation would involve 5.0 miles of the improved county Grove Creek Road requiring no reconstruction, 10.8 miles of improved county road (Meeteetse Trail and Robertson Draw Road) requiring minor reconstruction, 6.8 miles of unimproved two-track road requiring major reconstruction, and 0.3 miles of new road construction.

Southern Access - Robertson Draw Access Route (Variation A3)

The Southern Access - Robertson Draw Access Route variation would originate from Montana Highway 72 approximately 2.2 miles north of the Wyoming border. The access route follows a county road for 1.5 miles across the Clarks Fork to the Robertson Draw Road. From this point access to the drill site would be identical to the Meeteetse Trail -Robertson Draw Access Route (Variation A2) described previously. This variation would involve 1.5 miles of county improved road requiring no reconstruction, reconstruction or new construction of the bridge over the Clarks Fork, 5.7 miles of improved county road (Robertson Draw Road) requiring minor reconstruction, 5.7 miles of unimproved two-track road requiring major reconstruction, and 0.3 miles of new road construction.

Clark Wyoming Access Route (Variation A4)

The Clark Wyoming access route variation originates from Wyoming Highway 120 approximately 8.6 miles south of the Montana border. From this point the access route follows an improved county road for approximately 2.0 miles towards Clark, Wyoming, to an intersection with county road 8WC where the route turns north along this road for 2.4 miles to the intersection with county road 8VC. The access route follows this road west for approximately 0.5 miles to an intersection with a graded dirt road heading north to the Joanne Ranch. The access route heads north on this route for 6.1 miles along unimproved two-track roads to the Robertson Draw Road where this access route converges with Variations A2 and A3 and then follows Variation A2 and A3 routes to the drill site. This variation would involve 7.6 miles of county improved road requiring no reconstruction, 10.1 miles of unimproved two-track road requiring major reconstruction, and 0.3 miles of new road construction.

Alternative B - Gold Creek Drill Site and Access Route

The Gold Creek drill site is located in the Gold Creek drainage in the SW1/4 NE1/4 Sec 10 T9S R20E. Access to this site would utilize the same route as described under the proposed action to the terminus of Grove Creek Road. From that point, access would head west utilizing existing unimproved two-track roads leading to Gold Creek for 5.3 miles to an abandoned drill site. An additional 0.9 miles of new road construction would be required to access the drill site from this point, of which 0.5 miles would occur on Forest land. A 2.2-acre drill pad would be constructed at the Gold Creek drill site. Disturbance associated with this alternative would include 12.9 acres of

existing road reconstruction (two-track), 4.4 acres of new road construction, a 2.2-acre drill pad, and 0.8 acres of cut and fill slopes and topsoil stock pile associated with the drill site. Total disturbance would be 20.3 acres.

AFFECTED ENVIRONMENT

Introduction

Geology

The project area lies on the margin or transition between the Beartooth Mountains of the Middle Rocky Mountains Physiographic Province and the Big Horn Basin extension of the Great Plains Physiographic Province (Thomas 1965 and Foose, Wise and Garbarini 1961). More specifically, the project area lies on the alluvial plains, fans, terraces, and bedrock toe slopes of the eastern margin of the Line Creek Plateau, which is the northeast extension of the Beartooth Plateau of the Beartooth Mountains. The eastern escarpment of the Line Creek Plateau rises abruptly from the alluvial plains of the Clarks Fork of the Yellowstone River at an elevation of approximately 4,000 feet, to 9,400 feet on the surface of the plateau due west of the project area. The 5,400-foot vertical rise in elevation occurs in a horizontal distance of nine miles, with most of the rise (3,000 feet) occurring within two miles.

The Beartooth Mountains, Beartooth Plateau, and Line Creek Plateau can best be described as a block of the earth's crust consisting of Precambrian crystalline metamorphic and igneous rock uplifted approximately 20,000 feet to today's elevation (Foose, Wise and Garbarini 1961). The overlying sedimentary rocks have eroded away to expose the crystalline rocks of the block. In the immediate vicinity of the project area, this block has been thrust up and over the younger Paleozoic and Mesozoic sedimentary rocks along a series of deep-seated faults as well as along surface faults such as the Beartooth Fault, which parallels the eastern escarpment of the Line Creek Plateau. This tectonic movement caused the surrounding sedimentary rocks to buckle and tilt up at high gradients to form the unusual geologic formations known as the Meeteetse Spires and other similar palisades along the northeastern margin of the Beartooth and Line Creek plateaus. More recently in geologic time, the eastern escarpment of the Line Creek Plateau has been scoured and plucked by alpine glaciation forming subtle, shallow bowls and cirques in the headwaters of major streams such as Ruby Creek and Gold Creek. The glaciers deposited morainal material (ground and lateral moraines) on the toeslopes of the Line Creek Plateau while streams originating from glacial meltwaters deposited large outwash terraces, fans, and plains.

Potential natural geologic hazards in the project area include avalanches, rock falls, landslides, slumps, debris flows, and ground motion caused by earthquakes. Except for ground motion, these gravity-related hazards are transient in time, are highly localized, and have minimal areal extent and, therefore, do not pose significant danger or hazard to warrant special concern. The project area lies within the southwestern corner of the Montana Seismic Belt (Qamar and Stickney 1983). In recent geologic time, this area has been relatively quiet in regard to movement along faults and subsequent earthquakes. The project area lies in a Zone 2 seismic risk area (Coffman and

Von Hake 1973). This risk zone indicates that moderate damage could result from seismic ground motion. There are no known active faults in the immediate vicinity of the project area (Witkind 1975).

The proposed Ruby A Federal well is designed to test a large subthrust anticline along the east edge of the Line Creek Plateau in the northern Big Horn Basin. This well is projected to reach a total depth of 12,520 feet (true vertical depth approximately 11,600 feet) in the Ordovician Bighorn Dolomite. Primary objectives are the Cretaceous Frontier Sandstone, Permian Phosphoria Formation and Pennsylvanian Tensleep Sandstone. Other objectives include the Cretaceous Dakota Sandstone, Mississippian Madison Limestone and Ordovician Bighorn Dolomite. These formations have combined to produce over 500 million barrels of oil at Elk Basin Field, which is a large surface anticline located about 17 miles to the southeast of the project area. The targeted structure is a north-south trending compressional feature formed during the Laramide Orogeny from late Cretaceous to early Tertiary time. The structure was identified in the subsurface using seismic data that was integrated with limited well control.

The proposed well would be directionally drilled to a bottom-hole location approximately 3,700 feet northwest of the proposed drill site. The rig would commence drilling in vertical Paleozoic rocks at or near the surface and eventually penetrate roughly 2,000 feet of granite before re-entering sediments below a major thrust fault at 4,100 feet (true vertical depth). This fault has over 15,000 feet of vertical displacement and at least twice that much lateral offset. About 2,000 feet of overturned Mesozoic sediments are believed to exist below the granite. A normal, upright Cretaceous section is anticipated below the last major thrust fault at a depth of 6,100 feet. Subthrust Frontier and Phosphoria Formations are projected at true vertical depths of 6,900 and 9,800 feet, respectively. Exhibit A-1 presents the structural cross-section of the proposed directional drilling attempt.

Soils

Soils in the project area have formed on the eastern slopes, footslopes and alluvial plains of the Line Creek Plateau and on the floodplains of the Clarks Fork of the Yellowstone River. The soils within the project area are variable due to the large contrasts in topography, microclimate, vegetation, parent material, and geomorphic processes involved. Parent materials include igneous, metamorphic, and sedimentary bedrock; colluvium on the steeper slopes; and alluvium (including material deposited in glacial outwash plains). Most soils are in the Aridisol and Entisol orders of soil classification; some soils at the upper elevations of the alluvial plains and terraces are in the Mollisol order.

The following description of soil resources in the project area is based on field sampling and observation; analysis of samples collected in the project area; the soil survey of Carbon County, Montana area prepared by the USDA Soil Conservation Service (USDA-SCS 1971); and soils information presented by USDA-FS (1977). The Carbon County Soil Survey (USDA-SCS 1971) covers only the eastern portion of the project area to the Custer National Forest boundary (Forest boundary). The published soil survey contains the detailed maps showing the distribution and location of the various soil mapping units. A comprehensive and detailed soil survey has not been completed for the portion of the project area on FS-administered land. However, soil sampling and description were accomplished specifically at the drill site and access roads on Forest land as

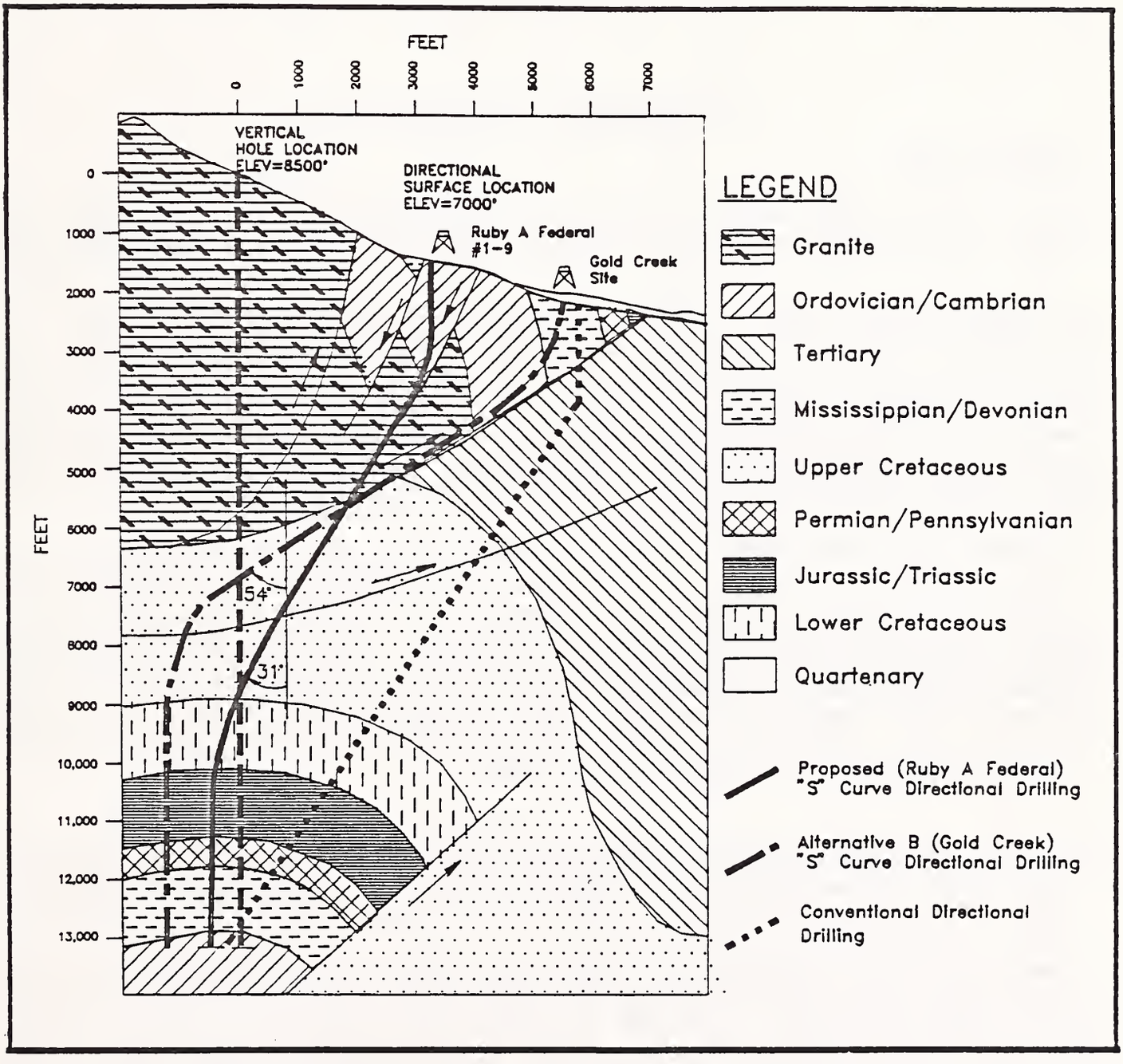

Exhibit A-1. Geologic Structure Cross-section of the Ruby A Federal No. 1-9 Drill Site, Gold Creek Drill Site, and Target Locations.

presented in the respective sections. Appendix A-1 of this report summarizes the results of the soil sample analysis. Important soil characteristics relative to determining impacts due to this project include erosion hazard or potential and revegetation potential. Table A-1 summarizes the characteristics of the major soils that occur in the project area.

Alternative A - Proposed Action

Access Route

From Montana State Highway 72, just west of the Clarks Fork of the Yellowstone River, access follows the improved county Grove Creek Road for approximately five miles. The first one and one-half miles of this road traverse land under irrigated cultivation at an elevation of approximately 4,000 feet. The soils in this section of road are predominantly level or nearly level, deep, well-drained clays of the Kyle series derived from weathered calcareous clay shales; silty clay loams of the Heldt series derived from deep alluvium; and clay loams of the Tonra series derived from alluvium. The Heldt series is classified as prime farmland (Klessens 1988). Prime farmlands include soils that provide the best combination of physical and chemical conditions for growing food, feed, forage, fiber, or oil seed crops. These soils include only those that are currently under production or are available for conversion to farmland.

The next three and one-half miles of the proposed access route traverse the bottomland of Grove Creek and rolling open upland covered with grasslands and sagebrush scrub near Grove Creek at elevations of 4,000 feet to 4,300 feet. The soils in this section of access route include Heldt, Kyle, Bowbac, Travessilla, Torchlight, and Midway series. These soils are deep clays, clay loams, and silty clay loams derived from deep alluvium and shale. These soils are well-drained, have very slow to slow permeabilities, slight to moderate erosion hazard, a high shrink/swell potential, and have a low stability hazard. Soil pH ranges from 6.6 to over 9.0. Road improvement and reconstruction are not planned on this five-mile length of existing road.

From the end of the improved county Grove Creek Road to the Forest boundary, the access route follows approximately eight miles of existing unimproved two-track roads. These roads will be improved with levels of effort ranging from minor bladework to major reconstruction. This portion of the route traverses relatively flat to hilly, gently sloping to steeply sloping glacial and alluvial outwash plains, terraces, fans, and rolling erosional surfaces at elevations from 4,300 feet to 6,200 feet. Soils of the first two miles of the access route include Romberg very stony loams, Midway-Travessilla association, Toluca clay loam, Vona fine sandy loam, and Torchlight clay soils. The Midway-Travessilla soils developed from shale beds, Toluca clays from deep calcareous loamy material, Vona fine sandy loam from alluvium, and Torchlight clay from highly alkaline and saline gypsiferous residuum. Runoff rates range from slow for the Vona soil to rapid for the Torchlight soil; erosion hazards range from slight for the Toluca soil to moderate for the other three soils; pH ranges from 6.6 for the Toluca soil to over 9.0 for the Torchlight soil; depth to high water table is greater than 60 inches for each of the four soils; permeabilities range from slow for the Midway and Torchlight series to rapid for the Vona series; and shrink/swell potential is low and moderate for the Vona, Toluca, and Midway-Travessilla soils and is high for the Torchlight clay soil. These soils are only poor to fair for road subgrade due to their high shrink/swell and frost

action potentials, and topsoil suitability is mostly poor due to high coarse fragment or clay content. These soils have a low stability hazard.

The majority of soils that the access route crosses from the end of Grove Creek Road to the Forest boundary are classified as Romberg Very Stony Loam, Romberg Extremely Stony Loam, Romberg-Shale Outcrop, and Stormitt complex. These soils are deep, well-drained very stony loams and gravelly clay loams that formed on terraces in deep glacial outwash typical of most of this section of road. There is a significant fraction of fragments larger than 3 inches in diameter contained in these soils, especially in the Romberg extremely stony loam which has large glacial erratic stones and boulders of granitic origin. Runoff rate is medium to rapid, erosion hazard is slight to moderate, permeability is moderate to moderately rapid, shrink/swell potential is low, depth to high water table is greater than 60 inches, and soil pH ranges from 6.6 to 9.0. Topsoil and road subgrade suitability of these soils are poor due to high coarse fragment content. These soils have a low stability hazard.

In the last mile before the Forest boundary, the access road crosses Maurice stony loam and Windham cobbly clay loam as it leaves the alluvial plains and climbs the small valley of Ruby Creek. Both soils are deep, well-drained, loamy, skeletal soils. Maurice stony loam developed from deep gravelly and cobbly alluvial material on fans and uplands, while the Windham cobbly clay loam developed from gravelly and loamy material weathered from limestone on footslopes and uplands. Runoff rate is medium, permeability ranges from moderate to very rapid, erosion rate is slight to moderate, pH is 7.4 to 8.4, and shrink/swell potential is low for these soils. These soils are fair to good for road subgrade but poor for topsoil due to high coarse fragment content. These soils have a low stability hazard.

Major road reconstruction would occur along the route of an existing unimproved two-track road for approximately 0.8 miles beyond the Forest boundary. This route climbs the valley of Ruby Creek and one of its northern tributaries from an elevation of 6,200 feet to an elevation of 6,800 feet. Based on extrapolation from the soils mapped adjacent to the Forest boundary, the route traverses Windham cobbly clay loam modified to varying degrees by an increase in granitic colluvium and ground moraine.

The soil takes on more characteristics of a granitic-derived soil and fewer characteristics of a limestone-derived soil the closer it is to the drill site area. As a part of this trend the soil characteristics tend more toward that of a sandy loam, and the quantity of granitic gravels, cobbles, and boulders tends to increase near the drill site.

To better characterize the soils on Forest lands (i.e., the portion of the project area not covered by USDA-SCS 1971), soil observation pits were excavated along this portion of the access route. The soils were observed to be deep with a typical sandy loam texture and a high coarse fragment content consisting primarily of granitics. Topsoil was observed to be 6 to 12 inches deep. Soil samples gathered at these observation points were analyzed for texture, coarse fragment content, organic material, lime, pH, salinity, phosphorus, potassium, and nitrate-nitrogen. Coarse fragment content (larger than 2 mm, excluding cobbles and boulders) and organic material content of the samples averaged 40 percent and 7 percent, respectively. The actual coarse fragment content is slightly higher since cobbles and boulders were excluded from the samples to facilitate analysis. No lime was detected; pH ranged from 6.0 to 6.4 and averaged 6.2; salinity ranged from 0.2 to 0.3 mmhos/cm and averaged 0.3 mmhos/cm. Phosphorus, potassium,

Table A-1. Characteristics of Major Soils along New and Reconstructed Access Routes and at Drill Sites (Revised from USDA-SCS 1971 and USDA-FS 1977).

Characteristic	SOIL MAPPING UNIT					
	Midway Travessilla-Hilly	Toluca Clay Loam	Torchlight Clay	Vona Fine Sandy Loam	Romberg Very Stony	Romberg Shale Outcrop
Landform	Upland Plains	Alluvial Terraces	Alluvial Fans	Alluvial Terraces	Rolling Terraces	Steep Terrace
Parent Material	Shale Bed	Calcareous loam	Alkaline Saline Residuum	Alluvium	Glacial Outwash	Glacial Outwash
Elevation	4,500 ft	4,500 ft	4,600 ft	4,800 ft	4,500 - 4,800 ft	4,600 ft
Slope	15-45 percent	4-8 percent	5-20 percent	2-4 percent	5-15 percent	20-40 percent
Vegetation	Sagebrush scrub	Sagebrush scrub	Sagebrush scrub	Sagebrush scrub	Sagebrush scrub	Sagebrush scrub
Taxonomy	Clayey, montmorillonitic Ustic Torriorthents	Fine loamy, mixed Ustollic Haplargids	Fine, montmorillonitic Vertic Torriorthents	Coarse loamy, mixed Ustollic Haplargids	Loamy skeletal, mixed Ustollic Haplargids	Loamy skeletal, mixed, Ustollic Haplargids
Depth	Shallow	Deep	Deep	Deep	Deep	Deep
Texture	Silty clay loam Silty clay	Clay loam	Clay	Fine sandy loam	Very stony loam Gravelly clay loam	Very stony loam Gravelly clay loam
Permeability	Slow	Moderate	Slow	Moderately rapid	Moderate	Moderate
pH	7.4-8.4	6.6-9.0	8.5->9.0	7.9-8.4	7.9-8.4	7.9-8.4
Water Capacity	0.14-0.18 in/in	0.15-0.18 in/in	0.10-0.14 in/in	0.04-0.08 in/in	0.04-0.08 in/in	0.04-0.08 in/in
Shrink/Swell Potential	Moderate	Moderate	High	Low	Low	Low
Depth: High Water Table	>60"	>60"	>60"	24"-60"	>60"	>60"
Depth: Bedrock	<20"	>60"	>60"	>60"	>60"	>60"
Drainage Class	Well	Well	Well	Well	Well	Well
Runoff Rate	Rapid	Medium	Rapid	Slow	Medium	Rapid
Erosion Hazard	Moderate	Slight	Moderate	Moderate	Slight	Moderate
Source of: Topsoil	Poor: steep slopes, clay	Poor: clay	Poor: alkaline, clay	Good content	Poor: high coarse fragment content	Poor: high coarse
Gravel	Unsuitable: fines	Unsuitable: fines	Unsuitable: fines	Unsuitable: fines	Poor: fines, large fragments	Poor: fines,
Road Subgrade	Poor: frost action	Poor: frost action	Poor: shrink/swell	Fair: frost action	Poor: large fragments fragments	Poor: large
Revegetation Potential	Fair	Fair	Poor	Fair to good	Poor	Poor

Table A-1. Continued.

Characteristic	SOIL MAPPING UNIT					
	Romberg Extremely Stony	Maurice Stony Loam	Windham Cobbly Clay Loam	Rentsac Rock Outcrop	Stecum	Como
Landform	Sloping Terraces	Alluvial Fans	Foot terraces slopes and fan	Steep uplands	Mountain Slopes	Gently rolling moraine
Parent Material	Glacial outwash	Glacial outwash, alluvium	Residuum from limestone	Calcareous aandstone	Residuum from granitic bedrock and moraine	Glacial moraine
Elevation	4,600-5,500 ft.	5,500 ft	5,500-6,500 ft	6,500-7,000 ft	7,000 ft	6,400-7,000 ft
Slope	15-30 percent	20-40 percent	10-20 percent	20-60 percent	30-80 percent	10-30 percent
Vegetation	Sagebrush scrub	Sagebrush scrub Limber pine woodland	Sagebrush scrub Limber pine woodland	Sagebrush scrub Limber pine woodland	Limber pine woodland Mixed conifer	Limber pine woodland Mixed conifer
Taxonomy	Loamy skeletal, mixed Ustollic Haplargids	Loamy skeletal, mixed Typic Cryoborolls	Loamy skeletal, carbonatic, Typic Calciborolls	Loamy skeletal, mixed Lithic Ustic Torriorthents	Sandy skeletal Typic Cryorthents	Sandy skeletal Typic Cryochrepts
Depth	Deep	Deep	Deep	Shallow	Shallow to Deep	Deep
Texture	Very stony loam Gravelly clay loam	Stony loam	Cobbly clay loam	Channery loam	Coarse sandy loam	Very bouldery loam Very bouldery sandy loam
Permeability	Moderate	Rapid	Moderately slow	Moderately rapid	Rapid	Rapid
pH	7.9-8.4	7.4-8.4	7.4-8.4	7.9-8.4	7.9-8.4	7.9-8.4
Water Capacity	0.04-0.08 in/in	0.04-0.08 in/in	0.04-0.08 in/in	0.04-0.08 in/in	0.04-0.08 in/in	0.04-0.08 in/in
Shrink/Swell Potential	Low	Low	Low	Low	Low	Low
Depth: High Water Table	>60"	24"-60"	>60"	>60"	>60"	>60"
Depth: Bedrock	>60"	>60"	>60"	<20"	>32"	>98"
Drainage Class	Well	Well	Well	Well	Well	Excessive
Runoff Rate	Medium	Medium	Medium	Very Rapid	Moderate	Slow to moderate
Erosion Hazard	Slight	Moderate	Slight	Severe	Moderate	Low
Source of:						
Topsoil	Poor: high coarse fragment content	Poor: high coarse fragment content	Poor: high coarse fragment content	Poor: high coarse fragment content	Poor: high coarse fragment content	Poor: high coarse fragment content
Gravel	Poor: large fragments	Unsuitable: fines	Unsuitable: fines	Unsuitable: quantity	Unsuitable: fines	Unsuitable: fines
Road Subgrade	Poor: large fragments	Fair	Good	Poor: shallow	Fair	Unsuitable: boulders
Revegetation Potential	Poor	Fair	Fair	Poor	Poor	Poor

and nitrate-nitrogen content ranged from 6.4 to 12.0 ppm, 307 ppm to 375 ppm, and 2.5 to 9.4 ppm, respectively, and averaged 8.3 ppm, 350 ppm, and 5.8 ppm, respectively. The analysis indicated poor soil fertility due to low phosphorus and nitrate-nitrogen content. The high coarse fragment content also lowers the utility of the soil for reclamation. Erosion hazard along this portion of the access route is slight to moderate. These observations and results of sample analysis verified the soil mapping unit extrapolation to the Forest lands.

From the end of the existing unimproved road to the drill site, new access road will be constructed across steep slopes that average 50 percent and have sections up to 60 percent at elevations from 6,800 feet to 7,000 feet over a length of approximately 800 feet. This portion of the access route segment has a moderate to high stability hazard due to the steep sideslopes. Depth to bedrock is shallow along this portion of the access route. The characteristics of soil on this section of new access road correlate most closely with the Windham and Rentsac series. Rentsac soils are shallow and well-drained; formed in calcareous loamy material weathered from calcareous sandstone, limestone, and dolomite; and have a channery loam texture. Runoff is moderate, erosion hazard is moderate, and depth to groundwater is deep. Existing erosion condition is stable. Permeability is moderately rapid, and pH ranges from 7.9 to 8.4. This soil has poor road subgrade suitability. Soil observation pits were excavated along this portion of the access route. A highly weathered calcareous sandstone was encountered at a depth of approximately 30 inches. Soil texture was a sandy loam with high coarse fragment content. Topsoil was observed to be 6 to 12 inches deep. Soil samples gathered at these observation points were analyzed for texture, coarse fragment content, organic material, lime, pH, salinity, phosphorus, potassium, and nitrate-nitrogen. The sample analysis indicated very similar characteristics to the results presented above. The high coarse fragment content also lowers the utility of the soil for reclamation. Erosion hazard along this portion of the access route is slight to moderate.

In addition to the proposed access route, three access route variations to the proposed drill site have been identified by the BLM and FS for consideration. Access route Variations A2 and A3 utilize existing improved and unimproved two-track roads on the glacial and alluvial plains, terraces, and bottomlands to the east of the Forest boundary. Soils in this area have been described and mapped by the SCS (USDA-SCS 1971). Both access routes traverse the same soil mapping units described for the proposed access route (Variation A1). According to the SCS (Labruska 1989), soils along access route Variation A4 have not been formally mapped or described. The same landforms, topography, and parent materials that occur along Variations A1, A2, and A3 are also present along this variation. Therefore, the soils along this variation are expected to be very similar to those discussed for the other access route variations. According to Labruska (1989), no prime farmlands or farmlands of state and local importance occur along this access route.

Drill Site

The proposed drill site is located on a saddle of a small ridge that extends southeast from the midslopes of Line Creek Plateau near the transition zone between sedimentary rocks such as Big Horn dolomite and the Precambrian granitics. The ridge truncates approximately 1,000 feet to the east of the drill site close to the end of the

existing unimproved road. The saddle is roughly a 250- by 300-foot area that slopes to the northeast through southeast. The slope varies from 15 to 30 percent and averages 20 percent. The saddle is at an elevation of 7,000 feet.

Soil at the drill site is shallow, skeletal, sandy loam and sandy clay loam derived from deep granitic alluvium and colluvium over a sandstone, limestone, or dolomite bedrock. The depth to bedrock is shallow. The soil characteristics correlate most closely with those of the Stecum series as described by USDA-FS (1977) due to the predominant influence of the granitics. Erosion hazard at the drill site is slight. Existing erosion condition is stable. Exposed small boulders and cobbles cover approximately 10 percent of the soil surface. Runoff is slight, permeability is rapid, and depth to groundwater is deep.

Three soil observation pits were excavated at the drill site and revealed a skeletal coarse sandy loam to 18 inches at which point high cobble and boulder content precluded deeper excavation. Approximately 6 to 12 inches of topsoil exists over the drill site. Two soil samples gathered from each observation pit were analyzed for texture, coarse fragment content, organic material, lime, pH, salinity, phosphorus, potassium, and nitrates. Coarse fragment content (larger than 2 mm, excluding cobbles and boulders) and organic material content in the samples averaged 49 percent and 6 percent, respectively. The actual coarse fragment content is slightly higher since cobbles and gravels were excluded from the samples to facilitate analysis. There was no lime detected in any of the samples; pH ranged from 5.9 to 6.3 and averaged 6.1; salinity ranged from 0.2 to 0.4 mmhos/cm and averaged 0.3 mmhos/cm. Phosphorus and nitrate-nitrogen content ranged from 1.9 to 19.0 ppm and 3.4 to 6.4 ppm, respectively, and averaged 9.6 ppm and 4.8 ppm, respectively. Potassium content was greater than 400 ppm for five of the samples and 317 ppm for one sample. The analysis indicated poor soil fertility due to low phosphorus and nitrate-nitrogen content. The high coarse fragment content also lowers the utility of the soil for reclamation.

Alternative B - Gold Creek Site

Access Route

As this access route is very similar to the Alternative A access route, the discussion for Alternative A applies to this alternative. Access to the Alternative B drill site follows the same route along the county road as Alternative A. From the end of the county road, this access route follows approximately 5.3 miles of existing unimproved two-track roads to the abandoned Amoco drill site. Elevations along this route range from 4,300 feet to 5,900 feet. The majority of the soils that this access route traverses include the Romberg soils as discussed under Alternative A.

In the last one-half mile to the abandoned Amoco drill site and Forest boundary, the access route leaves the Romberg soils and crosses strongly sloping Windham cobbly clay loam to the north of Gold Creek. The characteristics of Windham soil are discussed under Alternative A. This soil has the same increasing granitic influence higher on the slope as the section of Windham series soil beyond the Forest boundary as discussed under Alternative A.

From the Forest boundary, this route climbs the 15 to 20 percent slope from 6,400 feet to 6,940 feet along Gold Creek. The soil characteristics along this section of the access route correlate most closely with the Como series as described by USDA-SCS (1977). The Como series is moderately deep to deep, well-drained, very bouldery loam and very bouldery sandy loam formed in granitic glacial till and outwash terraces overlying limestone. Cobbles and boulders in this soil are granitic. The soil contains 20 percent to 60 percent rock fragments, with boulders ranging in size from one foot to six feet in diameter. This soil has slow to moderate runoff potential, low erosion hazard, rapid permeability, low shrink/swell potential, and greater than six feet to the water table. The soil is a poor source of topsoil and road subgrade due to high coarse fragment contents consisting of large cobbles and boulders. The soil along this section of road has a low stability hazard. Although no soil samples were collected along this section of the road, samples taken at the drill site were very similar and therefore representative of the new access road.

Drill Site

The drill site is located at 6,940 feet on a 20 percent slope with uniform smooth topography. The drill site area is covered with large granitic boulders ranging in size from one to over six feet in diameter. Cumulatively, these boulders cover over 10 to 20 percent of the area. The soil characteristics at the drill site (and along the last section of access road) correlate most closely with the Como series as described above. Three soil observation pits were excavated and soils observed to be skeletal coarse sandy loams to 12 inches at which point the high content of cobbles and boulders precluded deeper observation. Two soil samples gathered from each pit were analyzed for texture, coarse fragment content, organic material, lime, pH, salinity, phosphorus, potassium, and nitrate-nitrogen. Coarse fragment content (larger than 2 mm, excluding cobbles and boulders) and organic material content averaged 32 percent and 5 percent, respectively. The actual coarse fragment content is slightly higher since cobbles and boulders were excluded from the samples to facilitate analysis. No lime was detected; pH ranged from 5.9 to 6.3 and averaged 6.0; salinity ranged from 0.1 to 0.3 mmhos/cm and averaged 0.2 mmhos/cm. Phosphorus, potassium, and nitrate-nitrogen content ranged from 3.7 to 5.9 ppm, 275 ppm to 354 ppm, and 0.7 to 4.7 ppm, respectively, and averaged 5.0 ppm, 307 ppm, and 2.8 ppm, respectively. Existing erosion condition is stable. The analysis indicated poor soil fertility due low phosphorus and nitrate-nitrogen content. The high coarse fragment content also lowers the utility of the soil for reclamation.

ENVIRONMENTAL CONSEQUENCES

Introduction

Geology

Impacts that could occur within the project area fall into two general categories: 1) impacts to the geologic environment caused by project construction and operation, and 2) impacts to project facilities (including access roads) as a result of inherent geologic hazard or risk in the project area. Impacts to the geologic environment include alteration of existing topography, altering or otherwise damaging other mineral leases that may occur in the project area, initiation of landslides and mass failures, and

alteration or destruction of paleontological remains. Impacts that could occur to the project primarily include inherent geologic risk or hazard such as damage to project facilities due to earthquakes, landslides, mass failures and movement of earth material.

The following significance criteria were used to determine the significance of impacts to the geology due to the proposed action or alternatives:

Geologic Environment:

- New and/or reactivated landsliding occurred due to geomorphic changes resulting from project construction causing significant resource damage and/or affecting worker and public safety.

- Large scale topographic alteration occurred causing other related impacts such as on the visual resource.

- The destruction of paleontologic remains that would substantially add to the body of knowledge on paleontologic resources in the area.

Geologic Hazards:

- Earthquake induced strong vibratory ground motion capable of damaging project facilities occurred during project construction or operation, exposing workers and public to abnormal levels of safety risk or hazard.

- Avalanches, landslides, or debris flows occurred independently of project construction and operation which could result in damage to project facilities, and abnormally increased worker and public safety hazard.

Soils

Potential impacts that could occur as a result of implementation of the proposed project include the removal of vegetation, exposure and disturbance of soil and mixing of soil horizons, the subsequent increase in the susceptibility of soil to wind and water erosion, and subsequent loss of the soil resource. Increased surface runoff and erosion would occur primarily in the short-term and would decline naturally in time due to natural stabilization and surface crusting, as well as in response to properly spaced drainage structures, sediment control structures where needed, and mulching and seeding to promptly re-establish vegetation on disturbed areas. The exposure and disturbance of soil combined with the loss of soil due to erosion could reduce the quantity and productivity of topsoil for reclamation.

Topsoil would be segregated for revegetation purposes to assure that the natural fertility and reclamation potential of the soil are not reduced. On steep sideslopes, long sliver fills would need to be avoided so that soil material is not sidecast beyond the reach of equipment for reclamation. Avoidance of long sliver fills would also decrease the length of slope exposed to erosion. Indirect impacts to soils could occur from rutting and compaction from off-highway vehicles (OHV) as the result of increased vehicular access along the road into areas that currently have no or poor accessibility.

The following significance criteria were used to determine the significance of impacts to soils due to the proposed action or alternatives:

Soils:

- Implementation of the proposed action or alternatives would violate Forest-wide management direction and/or management area direction as described and mandated by the Custer National Forest LRMP and EIS (USDA-FS 1986) and the Billings Resource Area RMP (USDI-BLM 1983), respectively.
- Increased soil erosion that cannot be reduced by 75 percent after one year, and 95 percent after five years of soil disturbance due to project activities.
- Productivity of the reclaimed soil does not equal that of the predisturbance soil as indicated by success of revegetation (i.e., vegetal cover) such that predisturbance land use can occur.
- Construction on soils with moderate to high stability hazard.
- Prime farmlands, or farmlands of state and/or local importance are impacted.

Direct and Indirect Impacts

Alternative A - Proposed Action

Access Route

Geology. Since the inherent geologic hazards in the project area do not pose significant danger or public safety hazard, impacts related to natural geologic hazards would unlikely occur due to access road construction. Minimal topographic alteration would occur with access road construction. The 0.3 miles of new road construction across 50 percent slopes would cause some topographic alteration; however, the magnitude would be small. Access road construction and reconstruction would not incite landslides, mudslides, debris flows, slumps, or avalanches. The potential for encountering paleontologic remains during access road construction would be small due to the minimal excavation required to construct and reconstruct access roads. If these remains are encountered, Phillips would notify the FS and BLM of the find to determine the significance of the find and determine appropriate mitigation if required. The potential for damage of project facilities due to earthquakes would be minimal as discussed in Chapter 3. Impacts related to implementation of the Alternative A access route variations (A2, A3, and A4) would be similar to those described for Phillips' proposed access route (A1).

Soils. No road upgrade or reconstruction of the Grove Creek Road is expected, and therefore, no impacts to soils would occur along this five-mile segment of access route. Prime farmlands would not be impacted. The reconstruction required on most of the 8.8 miles of existing unimproved two-track roads would disturb approximately 21.3 acres of soil assuming a 20-foot-wide construction zone. This disturbance would primarily involve expansion of cut and fill slopes on relatively gentle (5 to 15 percent) sideslopes to accommodate a wider running surface and optimal placement of drainage control

structures such as culverts and ditches. As indicated in Table A-1, most of the soils have relatively high permeabilities, low runoff potential, and low to moderate erosion potential such that significant erosion is not expected. Although much of the soils have an unsuitable to poor rating for a source of gravel and road subgrade, these limitations are not expected to be significant for the relatively small scale of road reconstruction and new road construction, and the intended use of these roads. Successful reclamation of cut and fill slopes should be attainable although the relatively poor reclamation potential (Table A-1) of the low fertility and high coarse fragment soils would require aggressive reclamation techniques to maintain soil productivity. Further, the high coarse fragment content could hamper selective topsoil salvage and handling.

The Universal Soil Loss Equation (USLE) (USDA-FS 1980) was used to estimate soil erosion rates. Appendix A-2 discusses the methodology used to predict soil erosion. The results of this procedure indicated that increased erosion could be reduced to levels not considered significant. Unprotected surface soils would likely have an average erosion rate of approximately 11 tons/acre/year. Assuming best management practices including an aggressive revegetation and erosion control program, erosion would be reduced to one ton/acre/year after one year, which represents a 90 percent reduction in erosion. After five years, erosion would be reduced to approximately 0.5 tons/acre/year due to complete revegetation, representing a 95 percent reduction. Best management practices include protecting all disturbed areas with mulch, netting, and/or revegetation, depending on site-specific conditions, as soon after initial disturbance as possible during construction, drilling, and reclamation; controlling all surface runoff; and treating all runoff from the disturbed areas with sediment traps and silt fences. Best management practices relevant to this project are presented in several information sources including the USDA-FS Region 1 Soil and Water Conservation Handbook (FS Handbook 2509.22), and the joint BLM and FS "Gold Book or Oil and Gas Reclamation Handbook (USDI-BLM and USDA-FS undated). These information sources were used to prepare a site-specific erosion control, revegetation, and rehabilitation plan for the project. This plan is presented in Appendix D of the EIS. No slope stability problems are anticipated along this portion of the access road since stability hazard is low; therefore, no significant impact to soils is anticipated.

Construction of approximately 0.3 miles of new access road from the terminus of the existing road to the drill site would disturb approximately 1.5 acres of soil, of which 0.75 acres would entail steep soil with moderate stability hazard along an 800-foot segment with 50 to 60 percent slope. Erosion and the potential for slope instability along the balance of this segment would be similar to that described previously for the access route along existing unimproved two-track roads. Further, the high coarse fragment content along this segment of new road construction could hamper selective topsoil salvage and handling. Blasting of bedrock would be likely along this segment of new road construction due to the shallow depth to bedrock, however, blasting would not be extensive due to the highly fractured and weathered nature of the surficial bedrock. Successful reclamation should be attainable although the relatively poor reclamation potential of the low fertility and high coarse fragment soils would require aggressive reclamation techniques to maintain soil productivity. No significant impacts are expected to occur. If producible quantities of oil or gas are not encountered, the drill site would be abandoned and reclaimed, and the new access road from the Forest boundary to the drill site would be recontoured and reclaimed. If producible quantities were encountered, the cut and fill slopes of the new road would be secured for a two- to three-year interim period while additional environmental analysis (i.e., environmental

assessment and/or environmental impact statement) was conducted and the FS and BLM reached a decision concerning well production and field development. The cut and fill surfaces of the road would be secured from erosion as specified in Appendix D of the EIS.

The results of the USLE procedure indicated that increased erosion along this steep 800-foot segment of road could be reduced to levels not considered significant. Unprotected surface soils would likely have an average erosion rate of approximately 25 tons/acre/year. Assuming best management practices discussed previously, erosion would be reduced to three tons/acre/year after one year, representing an 88 percent reduction in erosion. After five years, erosion would be reduced to approximately 1.5 tons/acre/year due to complete revegetation, representing a 95 percent reduction. Construction along this steep section of access road would require extensive cut and fill. Long sliver fills would need to be avoided so that soil material is not sidecast beyond the reach of equipment for reclamation. Avoidance of long sliver fills through the implementation of bench cut and end haul construction could decrease the length of slope exposed to erosion. The inherent moderate to high stability hazard associated with this 800-foot segment of road could result in minor slumps and sloughs during wet years. If optimal drainage control is implemented, problems related to instability would not likely occur. The balance of new road, or 800 feet, to the drill site would traverse relatively gentle slopes (10 to 20 percent) with low stability hazard, and erosion similar to that previously described. Successful reclamation should be attainable although the relatively poor reclamation potential of the low fertility and high coarse fragment soils would require aggressive reclamation techniques to maintain soil productivity.

No significant impacts are anticipated to occur due to implementation of any of the Alternative A routing variations. These routing variations traverse the same soil mapping units in similar proportions as described for the proposed access route (A1). Of particular importance in regard to impacts on the soils environment include erosion potential or hazard and revegetation potential. Due to the same soil mapping units being traversed, the type and magnitude of impacts would be similar to those described previously for Phillips' proposed access. Variation A3 would involve the least disturbance (15.5 acres), followed by Variation A2 (18.0 acres), Phillips' proposed access road (A1) (22.8 acres), and Variation A4, which causes the greatest disturbance (23.8 acres). The difference between each variation is not considered substantial since the impacts associated with the disturbances would be fully mitigable through implementation of best management practices as discussed previously.

Drill Site

Geology. The discussion presented above for the access route also applies to the drill site. Based on currently available technical information and the interpretation of the size, location, and orientation of the target geologic structure, Phillips believes that the Ruby Creek drill site would provide them with the best opportunity of successfully reaching the target at the intended angle of approach as shown on Exhibit A-1.

Phillips prefers the Ruby Creek site (Alternative A) over the Gold Creek site (Alternative B) for the following reasons:

- The Ruby Creek site offers two important components to the feasibility of the directional drilling program: higher ground surface elevation and closer location

to the downhole drilling target. The higher elevation allows the vertical distance needed to achieve changes in angle for the drill bit. The distance from the wellbore to the target allows for a shorter horizontal distance, which also minimizes the angle needed to reach the target. This is displayed on Exhibit A-1 and further described as follows:

The Ruby Creek drill site has a ground surface elevation of 7,009 feet and a 3,700-foot horizontal displacement from the bottomhole location. The Gold Creek site has a surface elevation of 6,851 feet and a 5,500-foot horizontal displacement from the bottomhole location. These vertical and horizontal displacement figures substantially change the drilling angle required to reach the bottomhole location. For the Ruby Creek site, the drilling angle required to reach the bottomhole location is 31 degrees; for the Gold Creek site, the angle is 54 degrees.

As previously mentioned, Phillips proposes to drill a deviated (i.e., directional) exploratory well using specialized directional drilling equipment and techniques. In order to adequately evaluate the potential geologic structures, Phillips needs to enter the zones of interest vertically at the highest portion of the structure.

Entering the structures vertically is accomplished by drilling a sigmoid or "S"-shaped curve as shown on Exhibit A-1. The ability to drill directionally and enter the zones vertically is extremely important in obtaining reliable information regarding the subsurface structures.

Drilling the "S"-shaped curve is difficult. Experts in directional drilling (both Phillips personnel and drilling contractors experienced with directional drilling) agree that directional drilling an exploratory well at 54 degrees, as required by the Gold Creek site, is stretching the technical limits of current drilling abilities. Even drilling a 31-degree exploratory well for the Ruby Creek site is a high risk prospect. The Gold Creek site is an unacceptably high risk and virtually precludes Phillips' ability to evaluate the zones of interest during an exploratory test.

If the Ruby Creek site were drilled and hydrocarbons encountered, Gold Creek would be an acceptable site to drill the confirmation well or to place a development well. Development phase wells are drilled using the standard directional methods of one gradual curve to reach the target rather than the "S"shaped curve as shown on Exhibit A-1. This can be done at the development phase because the exploratory well would have pinpointed the zones to be developed. The conventional directional method is considerably more tolerant of large horizontal distance changes than the "S"-shaped curve method.

- The geologic characteristics of the Gold Creek drill site do not facilitate the success of directional drilling as opposed to the Ruby Creek site. The geologic characteristics of the Ruby Creek drill site allow for better control of angle and direction during drilling. This is due to faults in bedding planes running northeast-southwest along the east face of the Line Creek Plateau. The Ruby Creek site is west of the fault, and the Gold Creek site is east of this fault.

Considering the folding of subsurface formations and the angle changes needed to achieve an "S"-shaped curve, the Ruby Creek site would be a technically easier site from which to drill.

Phillips states that the risks and additional cost of drilling from the Gold Creek site are not quantifiable. Drilling from this site would be more difficult and take longer. Due to the low angle at which the wellbore would intersect the fault, it could become extremely difficult if not impossible to drill across the fault. It is preferred to cross faults at as high an angle as possible. The higher drilling angle combined with two turns in the "S"-shaped curve could result in 1) the drill pipe frequently getting stuck, thus increasing drilling time and costs; 2) increased costs in well completion and production operations; or 3) failure of the project.

Soils. Construction of the 1.7-acre drill pad would result in disturbance of approximately 2.5 acres of soil and would require a 28-foot cut and fill to accommodate the relatively small saddle with steepening slopes on all sides. Blasting of bedrock would likely be required at the drill site due to the shallow depth to bedrock; however, blasting should not be extensive due to the highly fractured and weathered nature of the surficial bedrock. Topsoil would be salvaged and selectively handled and stored away from construction activities. Cut slopes would be constructed to a 1:1 slope and fill slopes graded to a 1.5:1 slope. The bare soil would be left unprotected during the drilling phase. Increased erosion would occur on the bare soil; however, runoff and erosion control structures such as cutoff trenches, interception ditches, and diversion ditches would control surface runoff and erosion to minimal levels during the drilling phase.

If producible quantities of oil or gas were not encountered, the drill site would be recontoured to the approximate original contour and reclaimed. If producible quantities were encountered, the drill site would be secured for a two- to three-year interim period while additional environmental analysis (i.e., environmental assessment and/or environmental impact statement) would be conducted and the FS and BLM reached a decision concerning well production and field development. During this time, all disturbed surfaces would be protected from surface runoff and erosion through the implementation of measures presented in Appendix D of the EIS. Similarly, all runoff, drainage, and erosion control structures would be monitored and maintained in functional condition to minimize erosion and off-site sedimentation. The same measures and techniques, and therefore effectiveness of erosion control, would be used under either scenario including 1) a dry-hole with full reclamation, or 2) the interim decision-making period in the event producible quantities of oil/gas were encountered.

The results of the USLE procedure indicated that increased erosion on the partially reclaimed drill site during the interim decision-making period in the event of production, or on the reclaimed drill site in the event of non-production, could be reduced to levels not considered significant. Unprotected surface soils would likely have an average erosion rate of approximately nine tons/acre/year. Assuming best management practices previously discussed, erosion would be reduced to one ton/acre/year after one year, representing an 88 percent reduction in erosion. After five years, erosion would decline to approximately 0.5 tons/acre/year due to complete revegetation, representing a 95 percent reduction. Significant erosion, therefore, is not expected to occur. Similarly, no impacts related to soil instability are anticipated since

the drill site has a low stability hazard rating. Successful reclamation should be attainable although the relatively poor reclamation potential of the low fertility and high coarse fragment soils would require aggressive reclamation techniques to maintain soil productivity.

Alternative B - Gold Creek Site

Access Route

Geology. The discussion presented above for Alternative A also applies to the Alternative B access road.

Soils. The discussion presented under Alternative A applies to this alternative. Reconstruction of the 5.3 miles of the existing unimproved access road from the end of the county road to the abandoned Amoco drill site would cause similar impacts, including erosion estimations, as described under Alternative A.

From the abandoned Amoco drill site, new access road construction would partially follow an existing trail (0.5 miles) as well as traverse new terrain (0.4 miles). Impacts resulting from this construction would be similar to the new access road portion of Alternative A except for three points: Alternative B would not entail road construction across steep slopes; a short (100 feet) segment of Alternative B route just above the Forest boundary would encroach on a steep (70 percent) slope down to Gold Creek; and soils of the portion of the Alternative B access road from the Forest boundary to the drill site contain a high content of large boulders from one to over six feet in diameter. Fill material could fall down slope into Gold Creek where the access road encroaches on Gold Creek, making successful control of erosion, revegetation, and maintenance difficult. The large boulders along this portion of the access route would require special handling during construction as well as during reclamation to minimize the loss of topsoil. Special handling would entail separating the large boulders from the topsoil. It is unlikely that road construction would encounter bedrock due to the anticipated great depth of ground moraine, alluvium, and colluvium; therefore, blasting is not expected to be necessary.

Erosion could be reduced to levels not considered significant along reconstructed roads as well as along the new segment of access road. Erosion estimates for unprotected disturbed soil were determined to be approximately three tons/acre/year. After one year with erosion control and revegetation, erosion would be reduced by 90 percent to 0.3 tons/acre/year and after five years erosion would be reduced by 96 percent or 0.1 tons/acre/year, assuming best management practices discussed previously. Problems due to slope instability are unlikely along this road segment since the soils have a low stability hazard. The high coarse fragment content could hamper selective topsoil salvage and handling. Maintaining sufficient quantities of topsoil would require special effort. With aggressive reclamation and erosion control, no significant impacts would likely occur. Successful reclamation should be attainable, although, the relatively poor reclamation potential of the low fertility and high coarse fragment soils would require aggressive reclamation techniques to maintain soil productivity.

Drill Site

Geology. The discussion presented for Alternative A applies to the Alternative B drill site. Based on currently available technical information and the interpretation of the size, location, and orientation of the target geologic structure, Phillips believes that the Gold Creek drill site would not provide the best opportunity of successfully reaching the target at the intended angle of approach as shown on Exhibit A-1.

Soils. Construction of the 2.2-acre drill pad would result in disturbance of approximately three acres of soil, and would require a 29-foot cut and a 33-foot fill to accommodate the 25 percent gradient of the drill site. It is unlikely that drill site construction would encounter bedrock due to the anticipated great depth of ground moraine, alluvium, and colluvium; therefore, blasting is not expected to be necessary. Topsoil would be salvaged and selectively handled and stored away from construction activities. Similar to the access road, the large boulders that are common across the drill site would require special handling during drill pad construction and reclamation to minimize the loss of topsoil. Cut slopes would be constructed to a 1:1 slope, and fill slopes graded to a 1.5:1 slope. The bare soil would be left unprotected during the drilling phase. Increased erosion would occur on the bare soil; however, runoff and erosion control structures such as cutoff trenches, interception ditches, and diversion ditches would control surface runoff and erosion to minimal levels during the drilling phase as discussed previously.

If producible quantities of oil or gas were not encountered, the drill site would be recontoured to the approximate original contour and reclaimed. Regraded cut and fill slopes would be retopsoiled, mulched, and revegetated. If producible quantities were encountered, the drill site would be secured from erosion during the two to three-year decision making period as previously discussed under Alternative A. Using the USLE to estimate erosion rates indicated that increased erosion on the partially reclaimed drill site in the event of production, or on the reclaimed drill site in the event of non-production, could be reduced to levels not considered significant. Unprotected surface soils would likely have an average erosion rate of approximately 10 tons/acre/year. Assuming best management practices as described previously, erosion would be reduced to one ton/acre/year after one year, representing a 90 percent reduction in erosion. After five years, erosion would be reduced to approximately 0.5 tons/acre/year due to complete revegetation, representing a 95 percent reduction. Therefore, significant erosion is not expected to occur. Similarly, no impacts related to soil instability are anticipated since the drill site has a low stability hazard rating. The high coarse fragment content could hamper selective topsoil salvage and handling. Special effort would need to be expended to maintain sufficient quantities of topsoil. Successful reclamation should be attainable although the relatively poor reclamation potential of the low fertility and high coarse fragment soils would require aggressive reclamation and erosion control techniques to maintain soil productivity. No significant impacts are likely to occur.

Impacts Summary

Access Routes

Geology. No significant impacts to the geologic environment or impacts on the project, including facilities due to geologic hazards are expected under both alternatives and access route variations.

Soils. Prime farmlands and farmlands of state and local importance would not be impacted since no construction would occur along Grove Creek Road. Reconstruction and use of the existing unimproved "two-track" roads from the end of the maintained Grove Creek Road to the Forest boundary would result in similar impacts for Alternative A and Alternative B; however, Alternative A would involve approximately 1.3 miles of road in excess of Alternative B. Both access routes would involve soils with poor reclamation potential. With aggressive reclamation and erosion control, no significant impacts would likely occur under either alternatives. Soil productivity could be maintained and erosion condition returned to that of predisturbance on revegetated cut and fill slopes. Utilization of either access route would not violate management direction mandated by the Custer National Forest LRMP (USDA-FS 1986). Increased erosion due to soil exposure and disturbance could be reduced to acceptable levels along both access routes with prompt revegetation and erosion and runoff control. Slope stability problems are not anticipated with either access route.

From the Forest boundary to Alternative A and Alternative B drill sites, each access route poses different impact potential. Alternative A would involve 0.3 miles of new road construction across virgin terrain. Alternative B would involve 0.9 miles across virgin terrain. Alternative A would involve road construction across a 50 to 60 percent side slope that would require extensive cut and fill slopes, bedrock blasting, and increased maintenance requirements with standard construction techniques. In contrast, Alternative B would require road construction across soils with large boulders that would require special handling during construction and reclamation. Reclaiming the new portion of Alternative B would be more difficult than Alternative A due to the high content of large boulders. Although reclamation potential is poor, with the implementation of best management practices, reclamation of both access roads would be feasible. No significant impacts are anticipated along either access route on FS-administered land as discussed previously.

Since each access route variation crosses the same soil mapping units in approximately the same proportions, each route would involve the same soil erosion hazard and revegetation potential. Therefore, neither route would be environmentally preferred in this regard. Of the routing variations, Variation A3 would involve the least soil disturbance followed by Variations A2, A1, and A4.

Drill Sites

Geology. No significant impacts to the geologic environment or impacts on the project or facilities due to geologic hazards are expected under both alternatives. Based on currently available information, Phillips believes that the Ruby Creek drill site would provide the best opportunity of successfully reaching the target at the intended angle of approach compared to the Gold Creek site.

Soils. Alternative A and B drill sites could be constructed and reclaimed without significant impact. Both drill sites have poor reclamation potential; however, with aggressive reclamation and erosion control, no significant impacts would likely occur. Soil productivity could be maintained and erosion condition returned to that of predisturbance. Utilization of either drill site would not violate management direction mandated by the Custer National Forest LRMP (USDA-FS 1986). Increased erosion due to soil exposure and disturbance could be reduced to acceptable levels (i.e., erosion

condition) on both drill sites with prompt revegetation and erosion and runoff control. Slope stability problems are not anticipated with either drill site.

Alternative A drill site would likely require some bedrock blasting while construction of Alternative B drill site would likely not require blasting. Alternative B drill site would involve a larger area of disturbance, slightly greater cut and fill slopes, and large boulders that would require special handling during construction and reclamation in contrast with Alternative A drill site. Alternative B drill site, therefore, would pose greater direct impacts to the soil environment than Alternative A drill site although the increased level of impact would not be considered substantial.

Cumulative Impacts

Geology

No significant cumulative impacts are expected to occur to the geologic environment or to the project and facilities due to geologic hazard.

Soils

Existing land management activities that have impacted the soil environment to varying degrees within the project area primarily include grazing on non-Forest lands and road construction and use. In some areas grazing has been excessive resulting in soil compaction, vegetal cover removal, and subsequent increase in soil erosion. Road construction and use has caused an increase in soil erosion since a large portion of cut and fill slopes have not been protected from erosion with revegetation. Further, since most of the roads in the project area are unimproved, drainage and runoff control are sub-optimal. This adds to the increase in soil erosion over natural base rates. Overall, these impacts are not cumulatively significant and implementation of the proposed project would not significantly add to these impacts. Road improvement would likely reduce erosion levels with prompt revegetation of cut and fill slopes as well as the placement of optimal runoff and erosion control structures. Similarly, the abandoned Amoco drill site is adequately vegetated such that minimal erosion is occurring. Construction and reclamation of the drill sites would not add significantly to existing impacts. Therefore, no significant cumulative impacts are likely to occur due to implementation of the proposed project. Appendix B of the EIS discusses impacts due to field development and suggests that no cumulative soils impacts would be expected.

Mitigation Summary

Geology

No mitigation would be required since significant impacts are not expected to occur to the geologic environment or to the project and facilities due to geologic hazard. To minimize the potential for destruction of significant paleontological remains, all finds should be brought to the attention of the FS or BLM to determine if mitigation is required.

Soils

The site-specific and prudently applied reclamation plan presented in Appendix D of the EIS, combined with best management practices (FS Handbook 2509.22 and USDI-BLM and USDI-FS undated), would greatly reduce adverse impacts to soils, including erosion losses. Interceptor ditches encompassing the drill pad draining/flowing into/through sediment traps would control erosion and prevent off-site sedimentation. All topsoil should be stripped from areas to be disturbed, stored, and reapplied to ensure a productive growth media for plants. Stored topsoil should be secured from erosion loss by mulching and/or temporary revegetation. Successful and timely revegetation of disturbed areas, including implementation of a fertilization program, would greatly reduce impacts to soils. Special road construction using best available engineering design and best construction techniques (i.e., benching, partial benching with fill, barriers or retaining walls, end hauling, etc.) and monitoring plans (i.e., quality control, etc.) could reduce the hazards of crossing the 50 to 60 percent slopes near the terminus of Alternative A access. Special handling of the large boulders that would be encountered along the terminus of Alternative B access road and drill site during construction and reclamation would promote successful reclamation. The portion of Alternative B access that encroaches Gold Creek could be rerouted away from the stream environment to avoid impacts to the creek.

Unavoidable Adverse Impacts

No unavoidable adverse impacts would occur to the geologic or soils environment under either alternative assuming best management practices, successful implementation of Appendix D of the EIS, and specific mitigation measures listed in Chapter 5.

Comparative Analysis

No significant impact to the geologic environment would occur under either alternative. Soil impacts would primarily relate to increased soil erosion, reduction in topsoil productivity, reclamation feasibility, and road construction across sideslopes in excess of 40 percent with moderate stability hazard. The low fertility and high coarse fragment soils in the project area cause poor reclamation potentials. With aggressive reclamation, including erosion control, selective topsoil handling, and implementation of a fertilization program, soil productivity could be maintained, erosion reduced to near predisturbance condition, and successful reclamation attained.

Important impact contrasts between Alternative A and Alternative B include 25.3 acres of disturbance with poor or fair reclamation potential for Alternative A compared to 20.3 acres for Alternative B, 800 feet of new road construction across sideslopes in excess of 40 percent with moderate slope stability hazard under Alternative A compared to none for Alternative B, encroachment on a 70 percent sideslope down to Gold Creek along Alternative B compared to few boulders for Alternative A, and 0.9 miles of new road construction (4.4 acres) and 3.0-acre drill site requiring special handling of numerous large boulders along Alternative B compared to few boulders for Alternative A. Alternative A would require bench cut, end haul, and stock pile construction across the 800-foot steep sideslope to achieve successful reclamation. In contrast, Alternative B would require a total of 7.4 acres of disturbance requiring selective handling of large

boulders. Although successful reclamation is attainable for both alternatives, selective handling of large boulders to salvage sufficient quantities of topsoil would be more challenging and costly than special construction with Alternative A. The probability of successfully reclaiming Alternative A, therefore, would be higher than for Alternative B. Of the Alternative A routing variations, implementation of Variation A3 would cause the least impact (15.5 acres), followed by A2 (18.0 acres), A1 (22.8 acres), and A4 (23.8 acres). The proposed project would not violate existing management direction in regard to geology and soils.

Irretrievable and Irreversible Commitment of Resources

Any loss of topsoil during construction and reclamation activities or loss or reduction in soil productivity due to these activities would be an irreversible commitment of resources. This type of commitment is expected to be very small since best management practices as presented in Appendix D of the EIS and FS Handbook 2509.22 would minimize loss of topsoil. Minimal irretrievable commitment of resources would occur during project implementation due to a small amount of productive soils being covered with new or reconstructed roads. This commitment of resources would last until project termination and reclamation.

MITIGATION AND MONITORING

The mitigation measures and monitoring requirements that follow will be included in the Conditions of Approval for the drilling proposal if project approval is granted. The measures and requirements were developed in response to impacts identified in the Environmental Consequences chapter (Chapter 4) and through issues identified during the scoping process. The measures and requirements describe how drilling will be managed to assure compliance with the resource management goals and objectives of the Custer National Forest Land and Resources Management Plan (USDA-FS 1986), applicable lease stipulations, and resource limitations identified during interdisciplinary analysis. The following measures and requirements apply to Alternatives A and B unless otherwise noted. If deemed necessary in light of new facts or to minimize impacts, the following measures may be added to, modified, or selectively withheld. The Authorized Officer (AO) will determine final mitigation measures and monitoring requirements after consultation with the interdisciplinary team (IDT), who will have made recommendations based upon on-the-ground situation analysis.

Administrative and Preconstruction

- Conduct all operations in full compliance with applicable laws and regulations and the approved Application for Permit to Drill (APD, which includes the H_2S Contingency and Evacuation Plan).

- Phillips will adhere to applicable lease stipulations during all phases of the proposed drilling activity, or provide for written waiver of the stipulation(s) where adherence is not possible but acceptable with proper mitigation.

- Guide all phases of Phillips' exploratory drilling proposal, including road and drill site construction and maintenance and rehabilitation, by the dictates of the Clean Water Act. Control accidental discharge of all hazardous substances, including fuels, by methods described in a spill prevention and containment plan to be prepared by Phillips. Protect completely all single tanks of 660 gallons or larger and any aggregate of containers totalling 1,320 gallons or more.

- Utilize the Soil and Water Conservation Handbook (FS Handbook 2509.22, May 1988) and the Surface Operating Standards for Oil and Gas Exploration and Development (USDI-BLM and USDA-FS 1988) for reference to best management practices relating to road construction, drill pad construction, containment of drilling fluids and produced fluids and gases, and handling of all products and by-products of oil drilling.

- Phillips will submit for approval an access road design plan using roading guidelines approved for use by the Custer National Forest before starting construction.

- Phillips will submit for approval a road improvement plan for existing roads within the project area intended for use as part of exploratory drilling activities. The road improvement plan will specify road work needed to accommodate exploratory drilling activities. The plan will be agreed to in advance of any road improvement work by Phillips, the Bureau of Land Management (BLM) right-of-way requirements, and the Forest Service (FS). Phillips will schedule a review of this plan a minimum of 14 days in advance of anticipated start work date. Construction, reconstruction, and maintenance activities on county roads in the project area will be in accordance with a Memorandum of Understanding between Carbon County and Phillips.

- Phillips will prepare and submit a comprehensive drill site design plan to the BLM and FS for approval prior to initiation of construction. This plan will show the layout of the drill pad over the existing topography, dimensions of the pad, volumes and cross sections of cut and fill, location and dimensions of the cuttings trench, and access road egress and ingress.

- Phillips will slope-stake all construction activities and receive approval by the FS prior to start of construction.

- Require a qualified inspector to be on-site during all construction and reconstruction activities to assure contractor compliance with approved road and drill site design plans. Phillips will provide the qualified inspector.

Access Roads

Construction:

- Minimize the width of the construction zone to that absolutely necessary to perform the road construction.

- Selectively salvage between 6 and 12 inches of topsoil (i.e., suitable plant growth material) from the construction right-of-way (ROW) prior to construction. Store topsoil away from construction area and other subsoil materials to minimize loss of the topsoil resource.

- Selectively remove large boulders from topsoil prior to topsoil salvage and/or transport to facilitate minimization of the loss of topsoil.

- Locate areas of topsoil excess that could be used to meet topsoil deficits. Transport topsoil from surplus areas to deficit areas so that at least 6 inches of topsoil is spread over disturbed areas to be revegetated.

- Design and construct optimum erosion and runoff control structures to reduce accelerated erosion and increased off-site sedimentation.

- Bench cut and end haul construction across the 800-foot-long, 50 to 60 percent slope near Alternative A drill site is recommended over conventional cut and fill construction to facilitate road maintenance as well as final reclamation.

Reclamation:

- Respread an average of 6 inches of topsoil on all cut and fill surfaces of reconstructed existing roads, and mulch, seed, and fertilize all disturbed areas according to the site-specific erosion control, revegetation and rehabilitation plan (ERRP) provided in Appendix D of the EIS.

- Recontour all new road on Forest and BLM lands (if required) to approximate original contour and respread an average of 6 inches of topsoil across the recontoured ROW surfaces. Mulch, seed, and fertilize all disturbed areas per Appendix D of the EIS.

- Protect all topsoil stockpiles from erosion by mulching, netting, matting, and/or revegetation.

- In areas with high boulder content, selectively handle boulders to facilitate topsoil respreading. Boulders should be randomly replaced and/or buried over the area to reduce visual impacts.

- Design and construct optimum erosion and runoff control structures such as waterbars and turnouts to reduce accelerated erosion and off-site sedimentation per Appendix D of the EIS.

- Monitor all reclaimed areas for successful reclamation in terms of reduced erosion and revegetation success per Appendix D of the EIS.

Drill Sites

Construction:

- Minimize the area of disturbance to that absolutely necessary to construct the drill pad and any ancillary facilities.
- Selectively salvage a minimum of 12 inches of topsoil from the drill pad area prior to construction. Store topsoil away from construction area and other subsoil materials to minimize loss of the topsoil resource.
- Selectively remove large boulders from topsoil prior to topsoil salvage and/or transport to facilitate minimization of the loss of topsoil.
- Design and construct optimum erosion and runoff control structures such as cutoff trenches, interception ditches, waterbars, etc., to reduce accelerated erosion and increased off-site sedimentation per Appendix D of the EIS.

Reclamation:

- A site-specific ERRP for both Alternative A and Alternative B is presented in Appendix D of the EIS. This plan includes a document summary, project administration, site specific ERRP measures, and monitoring and maintenance. All reclamation practices associated with the drilling proposal will conform with the approved standards and methods provided in this plan.

FIELD DEVELOPMENT SCENARIO

Well Development

Phillips proposes to drill the Ruby A Federal No. 1-9 Prospect to determine the presence of hydrocarbon reserves and evaluate the commercial potential of the reserves, if encountered, by conducting various tests. These tests would include analyzing drill cutting samples to detect evidence of oil, drill stem tests to determine more closely the performance of the hydrocarbon reservoir's productive capacity, and electrical log surveys to determine reservoir porosity and presence of oil and/or gas. Depending on the outcome of the testing program, Phillips may choose to permanently plug the well and abandon and reclaim the location, temporarily plug or shut-in the well until decisions are reached regarding future production options, or request approval to enter production operations.

The following discussion describes activities associated with producing this one proposed exploratory well.

Oil Well Development

If the well is an oil producer, several steps would be taken to test, complete, or develop the well. These steps would occur on the well pad and normally include the following actions: installation and cementing of well casing; perforation of the reservoir;

installation of production tubing; and installation of control heads (an assembly of valves and gauges called a "Christmas Tree") to regulate the rate of flow from flowing wells, or the installation of a pumping unit or other lifting mechanism to lift oil to the surface in a non-flowing well. Equipment off-site would include installation of a battery of tanks for storing the oil and installation of equipment to separate oil, gas, and water so that the oil meets sales requirements. Segments of the drill pad not needed for production operations would be regraded, topsoiled, and revegetated as per a comprehensive reclamation plan developed by Phillips and approved by the FS/BLM. Cut and fill slopes associated with drill pad construction would be revegetated. The access road to the drill pad and production facilities would remain in place for maintenance and production development purposes.

Initially, if hydrocarbons were encountered, production from the well would be stored at the production facility in tanks and trucked to market facilities. The number of trucks per day would be commensurate with the rate of production encountered. Production operations would require use and maintenance of an access road from the production facility to Montana State Highway 72 on a year-long basis. Maintenance during the summer and early fall months would be typical of graveled road maintenance in the area. Maintenance during the winter months would be relative to the amount of production encountered.

Winter maintenance would include blading or plowing snow from the access road in a manner prescribed in a plan of operations prepared by Phillips and approved by the FS/BLM.

Gas Well Development

Much of natural gas production is associated gas produced with oil. As a result, natural gas production is influenced by oil well development and production practices. There are, however, certain features of gas well development that are specific to gas production. Reservoir pressure is the controlling factor in the ability of a gas well to produce. Estimating the reserves and forecasting production rates and production life are early considerations in determining the economic feasibility of gas well completion and development. Completion of a gas well includes steps comparable to that of an oil well. Casing, tubing, and well head equipment are selected on the basis of flow rates, fluid erosion, and chemical corrosion. Safety shutoff equipment is more critical and must meet higher design standards. Compressors may be needed to help the gas enter the pipeline if the well producing pressure at the surface is less than pipeline pressure. In either case, safety and flow regulator valves are installed at the well head. The equipment and fittings must meet standards set by the American Petroleum Institute (API) following sizes and ratings established by the American National Standards Institute (ANSI) if corrosive conditions are expected.

Based on what Phillips knows of the geology of the area, their targeted formations described in the APD, and the negligible quantities of gas encountered during previous drilling attempts by other companies in the area, Phillips does not expect to encounter gas during the drilling of this exploratory well. If non-producible quantities of gas are encountered (i.e., not economical to produce), with producible quantities of oil, the gas would likely be flared or vented off as authorized by an approved venting or flaring permit issued by the BLM.

Field Development

Oil and/or gas field development generally requires more than one well to efficiently extract the hydrocarbon reservoirs. Well density and location are designed to efficiently extract the oil/gas reserves based on specific reservoir characteristics, economics, and environmental considerations. Most of the information required to determine appropriate well density and locations is not available until after the reservoir has been penetrated and production characteristics have been established during the exploratory phase. After considering all pertinent information, the well density would be subject to the approval of the State of Montana Oil and Gas Conservation Board and the BLM.

The following discussion regarding development of the Ruby A Federal No. 1-9 Prospect is based on what Phillips currently knows of the geology of the Ruby area from seismic interpretations and established well control data from fields to the northeast and southeast of the prospect area.

Only after exploratory drilling would more complete information regarding the geologic structures of interest be known. Once this geologic information is gained, more concrete determinations regarding the intensity and extent of field development would be made by Phillips. If oil or gas is present in commercial quantities, wells would be completed and production equipment and facilities installed. Development activity might be limited to drilling, plugging, and reclaiming the current drilling proposal or extended to drilling numerous wells from three well sites, with their attendant tank batteries, electric lines, and access roads.

The three proposed well sites are located such that Phillips should be able to reach and develop 80 percent of the leasehold. Because of the structures being drilled and drill site vertical and horizontal displacement limitations, all three well sites would be located on the Custer National Forest. Directionally drilling the Ruby Prospect requires a high vertical elevation location and a limited horizontal distance to the downhole drilling target. The higher elevation allows the vertical space needed to achieve changes in direction for the drill bit. The horizontal distance from the wellbore to the target must be as short as possible to minimize the angle needed to reach the target. Phillips estimates that moving off-Forest would limit the potential development of these leases to less than 30 percent using conventional directional drilling methods.

Aspects of field development as currently envisioned by Phillips include the following:

- Confirmation Well - If the initial exploratory well encountered hydrocarbons (either gas or oil), an additional exploratory well, called a confirmation well, would likely be drilled to confirm the findings. This well would be drilled from a drill site location approved through the NEPA process. The confirmation well would be directionally drilled to test the extent of the geologic structure in another direction. This well would also help evaluate the hydrocarbon potential of the structure.

- Production Wells - The steep topography of the east face of the Line Creek Plateau and the perceived location of the geologic structure limits the number of suitable well site locations available for field development. As a result, as many wells as feasible would be drilled from each of the three well sites. Phillips estimates that a maximum of six directional production wells could be drilled

from each well site, for a maximum of 18 producing wells within the field. Phillips would attempt to complete one production well annually on each of the well sites, for total well development in six years. This estimate assumes few drilling and completion problems. Phillips estimates a range of six to ten years or longer to complete the wells, with allowance for drilling and completion problems. The actual number of wells that could be expected from each well site would be better known following evaluation of the original test well and the confirmation well. Each well site would be equipped with one well head for each producing well and surface piping as needed to operate the method of well pumping utilized. Phillips currently plans to use hydraulic well pumps. These pumps were selected because they are unobtrusive, quiet, and operate on produced oil.

- Production Facilities - One off-site production facility is anticipated for each well site and would be located up to three miles from the well site. Phillips has proposed off-site production facilities to reduce the frequency of required visits to each well site for monitoring and maintenance purposes. Well visits for servicing operations would occur weekly during the winter and spring months. During the summer and fall months, wells could be visited more frequently. The use of automatic shutdown systems and well control from the remote production facilities would preclude the need for daily visits. Well sites would be accessed from the production facilities by enclosed motor vehicle during the winter months. Access roads to the production facilities and the producing well sites would remain open year-round.

  The production facilities would require electrical power, continual access, and numerous pieces of production equipment as described above. Electricity would be brought in to the production facilities either from the north or south by tying into existing power sources. Likely powerline corridors from existing power sources to the production facilities would follow the transportation systems. Power poles and line configurations would be designed to reduce impacts to raptors. Electricity would be located underground from the production facilities to the well pads.

  Phillips plans to install all flowlines, power oil/lift gas, instrument gas, electricity, and heating lines underground in the access road corridor, as needed, from the well sites to the production facilities to operate equipment at the well sites remotely. The number, size, and use of these lines would be determined by the characteristics of the hydrocarbon being produced. Characteristics and behavior of the hydrocarbon reservoir may make necessary changes from one production method to another over the life of the field.

- Pipeline/Transportation - Pipelines for fluids from the wells to the production facilities would be laid within the existing road right-of-way. Pipeline routes utilized from the production facilities to a tie-in with existing pipeline(s) would depend on the product destination (i.e., the purchaser of the product). There are several existing underground pipelines that could be utilized. These pipelines include three Husky lines (2-inch, 3.5-inch, and 4-inch), an Amoco 12-inch line, and a Marathon Oil 6-inch line. These lines are located approximately 12 to 15 miles to the east of the Ruby A Federal No. 1-9 field and generally parallel Wyoming Highway 120 and Montana Highway 72.

Crude oil from the production facilities would be transported to market by pipeline if the volumes produced are large enough to justify the expense of laying the lines. If this justification cannot be made, crude oil would be hauled from the production facilities by tanker trucks and transported to a truck unloading depot where the crude oil would be unloaded into a pipeline leading to a larger interstate pipeline. Production amounts would be monitored by means of a Lease Automated Custody Transfer unit (LACT), or hand gauging.

Pipeline construction would occur in a planned sequence of operations common to oil/gas pipeline installation specifications and would take place along a corridor of continuous activity. All pipeline installation work would be completed by a contractor working under Phillips supervision. An average 50-foot width of disturbance is anticipated.

The actual pipeline location would be surveyed and staked prior to start of construction activities. The pipeline corridor would be cleared of heavy brush prior to earth-disturbing activities. Topsoil would be stripped starting from the center of the corridor, or center line of the trench, and windrowed along the outside edges of the right-of-way (ROW). The route would be graded as necessary for passage of construction equipment.

Subsoil would be removed and stockpiled separately from topsoil. The ditch would be excavated mechanically with ditching equipment. The width of the ditch would vary depending on the size of pipe being laid. For example, the ditch width would be 14 inches for a 4-inch-diameter pipe and 18 inches for a 6-inch-diameter pipe. The ditch would be of sufficient depth to permit a minimum cover of 36 inches over the pipe.

Pipe-laying activities would include pipe stringing, bending, welding, coating, lowering of pipeline sections, and backfilling. Special construction measures would be utilized where pipelines cross stream channels. Subsoil would be backfilled into the trench over the pipe. Site regrading would occur where necessary. Topsoil would be evenly spread over the disturbed area to a maximum depth of six inches, and reclamation of the pipeline route would occur as authorized by the BLM and the fee-surface owner.

Natural gas, if produced in sufficient quantities, would be transported by pipeline. The procedure utilized in transporting natural gas by pipeline is similar to that described for oil. As previously mentioned, based on what Phillips knows of the geology of the area, their targeted formations described in the APD, and the negligible quantities of gas encountered during previous drilling attempts by other companies in the area, Phillips does not expect to encounter gas during the drilling of this exploratory well. If non-producible quantities of gas are encountered with producible quantities of oil, the gas would be flared or vented as authorized by an approved venting or flaring permit issued by the BLM.

- Safety Systems - Because of the remoteness and sensitivity of the project area and operational timing constraints, safety shutdown systems would be included in the production facilities and well sites. Automatic shutdown systems would be used to assure that the wells cease operations when the flowline pressure is too high or low or if the well itself experiences an operations problem. The

production facilities would also be operated with shutdown systems to control tank fillage. If for some reason tank space is limited, the wells would be shut in by high level controllers in the tanks. Automatic shutdown systems using a variety of technologies are available. The system used could include electronic equipment requiring electricity at the well pad, spring and pressure activated systems that do not require electricity, or a combination of the two. The well heads would be equipped with surface safety valves. Flowlines would be equipped with high- and low-pressure shutdowns. The tank battery facilities would be equipped with high- and low-pressure shutdowns on the pumps and high-level shutdowns on tankage. Secondary containment for all tankage would also be provided by a berm around the batteries and/or facilities site.

Impacts Due To Field Development

Geology

Impacts that could occur within the project area fall into two general categories: 1) impacts to the geologic environment caused by project construction and operation, and 2) impacts to project facilities (including access roads) as a result of inherent geologic hazard or risk in the project area. Impacts to the geologic environment include alteration of existing topography, altering or otherwise damaging other mineral leases that may occur in the project area, initiation of landslides and mass failures, and alteration or destruction of paleontological remains. Impacts that could occur to the project primarily include inherent geologic risk or hazard such as damage to project facilities due to earthquakes, landslides, mass failures and movement of earth material.

Since the inherent geologic hazards in the project area do not pose significant danger or public safety hazard, impacts related to natural geologic hazards would not likely occur due to project construction and operation. Minimal topographic alteration would occur with project construction. These construction activities would not incite landslides, mudslides, debris flows, slumps, or avalanches. The potential for encountering paleontologic remains during project construction would be small due to the minimal excavation required to construct project facilities. If these remains are encountered, Phillips would notify the FS and BLM of the find to determine the significance of the find and determine appropriate mitigation if required. The potential for damage of project facilities due to earthquakes would be minimal as discussed in Chapter 4 of the EIS.

Soils

Potential impacts that could occur as a result of implementation of the field development project include the removal of vegetation, exposure and disturbance of soil and mixing of soil horizons, the subsequent increase in the susceptibility of soil to wind and water erosion, and the subsequent loss of the soil resource. Increased surface runoff and erosion would occur primarily in the short-term and would decline in time due to natural stabilization and surface crusting as well as in response to properly applied drainage structures, sediment control structures, and mulching and seeding to promptly re-establish vegetation on disturbed areas. The exposure and disturbance of soil, combined with the loss of soil due to erosion, could reduce the quantity and productivity of topsoil for temporary and final reclamation.

Topsoil would be segregated for revegetation purposes to assure that the natural fertility and reclamation potential of the soil are not reduced. Indirect impacts to soils could occur from rutting and compaction from off-highway vehicles (OHV) as the result of increased vehicle access along the access road system.

The characteristics of the soils in the field area are presented in Table A-1 of the EIS. With completion of the field development project, approximately 64 acres of soils would be disturbed with implementation of the Northern Transportation System and 55 acres with the Southern Transportation System. This area includes 8.5 acres for drill sites, 3.0 acres for tank batteries (i.e., one acre per battery site), 15 acres for new road construction (3.1 miles) under both transportation systems, and 37 and 20 acres for road reconstruction under the northern and southern transportation system, respectively. Pipelines from the well sites to the production facilities would be buried within access road rights-of-way; therefore, no additional soil disturbance would occur. Additional soil could be disturbed during construction of pipelines that would transport the product to existing pipelines. The location and total distance of these pipelines are not known at this time.

Most of the soils have relatively high permeabilities, low runoff potential, and low to moderate erosion potential such that significant erosion is not expected. Successful reclamation of cut and fill slopes should be attainable although the relatively poor reclamation potential due to the low fertility and high coarse fragment content of the soils would require aggressive reclamation techniques to maintain soil productivity. Further, the high coarse fragment content could hamper selective topsoil salvage and handling. The large boulders along portions of the access routes, drill sites, and tank battery sites would require special handling during construction as well as during reclamation to minimize the loss of topsoil. Special handling would entail separating the large boulders from the topsoil. Cut and fill slopes of all access roads and facilities sites would be mulched and revegetated to minimize soil erosion and reduction in soil productivity.

Assuming best management practices, including an aggressive revegetation and erosion control program (FS handbook 2509.22, Appendix D of the EIS, and the Surface Operating Standards for Oil and Gas Exploration and Development: USDI-BLM and USDA-FS 1988), erosion would be reduced by more than 75 percent after the first year of construction and by more than 95 percent after five years, as discussed in Chapter 4 of the EIS. Thus, soil erosion is not expected to be a problem with field development.

Existing land management activities that have impacted the soil environment to varying degrees within the project area primarily include grazing on non-Forest lands and road construction and use. In some areas grazing has been excessive, resulting in soil compaction, vegetal cover removal, and subsequent increase in soil erosion. Road construction and use has caused an increase in soil erosion since a large portion of cut and fill slopes has not been protected from erosion with revegetation. Further, since most of the roads in the project area are unimproved, drainage and runoff control are sub-optimal. This adds to the increase in soil erosion over natural base rates. Overall, these impacts are not cumulatively significant, and implementation of the proposed project would not significantly add to these impacts. Prompt revegetation of cut and fill slopes as well as the placement of optimal runoff and erosion control structures would likely reduce erosion levels from the road improvement; therefore, no significant cumulative impacts are likely to occur due to implementation of the proposed project.

The measures presented in the site-specific reclamation plan presented in Appendix D of the EIS, combined with measures presented in FS Handbook 2509.22 and in USDI-BLM and USDA-FS (1988), would greatly reduce adverse impacts to soils, including erosion losses. Interceptor ditches encompassing drill pads and battery sites that drain/flow into/through sediment traps would control erosion and prevent off-site sedimentation. All topsoil should be stripped from areas to be disturbed, stored, and reapplied to ensure a productive growth medium for plants. Stored topsoil should be secured from erosion loss by mulching and/or temporary revegetation. Successful and timely revegetation of disturbed areas, including implementation of a fertilization program, would greatly reduce impacts to soils. Special handling of the large boulders that would be encountered along or at field facilities would promote successful reclamation. Application of these measures would greatly reduce the probability of significant impact to soil resources due to field development.

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APPENDIX A-1

Results of Soil Sample Analysis

APPENDIX A-1

Results of Soil Sample Analysis

UTAH STATE UNIVERSITY · LOGAN, UTAH 84322

SOIL, PLANT and WATER
ANALYSIS LABORATORY
UMC 48

November 10, 1988

Oliver Grah
PO Box 3516
Logan, UT 84321

Soil samples received 10/21/88.

		SAND SIEVE						%HYDROMETER						mmhos/cm	ppm				ppm
USU#	ID	VC	C	M	F	VF	Tot.	S	SI	C	Text.	*Lime	pH	Ece	P	K	%>2mm	%O.M.	NO_3-N
3174	1	20.7	16.7	8.1	9.4	3.3	58.2	58	20	22	Sandy Clay Loam	0	6.3	.3	5.4	>400	43.8	4.90	6.4
3175	2	21.9	18.6	9.3	9.4	3.0	62.2	62	18	20	Sandy Loam	0	6.1	.3	1.9	317	59.8	5.27	4.1
3176	3	14.1	16.3	10.0	12.7	5.0	58.1	64	21	15	Sandy Loam	0	5.9	.2	19	>400	35.5	10.5	6.4
3177	4	12.6	16.6	10.5	12.9	5.0	57.6	59	21	20	Sandy Clay Loam	0	6.0	.3	18	>400	60.7	----	3.4
3178	5	16.3	15.3	8.9	10.6	3.5	54.6	66	19	15	Sandy Loam	0	6.0	.4	9.5	>400	45.6	15.1	5.1
3179	6	18.2	16.7	9.9	11.9	4.3	61.0	61	18	21	Sandy Clay Loam	0	6.0	.2	3.7	>400	50.4	-----	3.5
3180	7	17.1	15.7	8.1	12.5	5.9	59.3	60	27	13	Sandy Loam	0	6.3	.2	5.1	315	19.8	10.0	3.2
3181	8	22.4	18.6	9.8	12.5	4.9	68.2	62	24	14	Sandy Loam	0	6.1	.1	3.7	283	42.8	3.45	2.6
3182	9	13.4	16.3	9.2	13.0	5.9	57.8	59	30	11	Sandy Loam	0	5.9	.1	5.9	275	10.8	9.5	2.6
3183	10	13.8	16.1	8.9	13.2	6.3	58.3	60	28	12	Sandy Loam	0	6.0	.1	4.6	286	28.8	-----	.7
3184	11	22.2	13.8	7.0	9.4	3.8	56.2	58	31	11	Sandy Loam	0	6.0	.3	5.8	354	40.9	9.8	4.7
3185	12	18.3	13.8	7.4	11.4	5.0	55.9	59	28	13	Sandy Loam	0	5.9	.2	5.3	327	50.3	------	2.9
3186	13	16.1	19.7	12.9	15.1	4.7	68.5	71	18	11	Sandy Loam	0	6.4	.3	6.4	367	49.5	8.1	5.5
3187	14	17.1	21.3	12.4	13.7	4.5	69.0	71	15	14	Sandy Loam	0	6.0	.3	12	375	36.2	6.1	9.4
3188	15	14.9	20.2	12.8	15.3	5.5	68.7	71	15	14	Sandy Loam	0	6.3	.2	6.5	307	33.3	6.1	2.5

*Lime: 0 - None
+ - Some Lime
++ - A lot of Lime

K. Topp

SOIL RESOURCES TECHNICAL REPORT

Key to Soil Sample ID No.

Sample ID No.	Depth (in)	Location
1	0-6	Ruby Creek Drill Site
2	6-12	Ruby Creek Drill Site
3	0-6	Ruby Creek Drill Site
4	6-12	Ruby Creek Drill Site
5	0-6	Ruby Creek Access Road, upper
6	6-12	Ruby Creek Access Road, upper
7	0-6	Gold Creek Drill Site
8	6-12	Gold Creek Drill Site
9	0-6	Gold Creek Drill Site
10	6-12	Gold Creek Drill Site
11	0-6	Gold Creek Access Road, upper
12	6-12	Gold Creek Access Road, upper
13	0-6	Ruby Creek Access Road, lower
14	6-12	Ruby Creek Access Road, lower
15	0-6	Gold Creek Access Road, lower

APPENDIX A-2

Application of the Universal Soil Loss Equation

Methods

Modified Soil Loss Equation

Soil erosion can be estimated using either physically based models, or empirical models. Physically based models generally produce more accurate results; however, the data and expense of operating the model over a wide range of applications are typically prohibitive in natural resource management situations. Empirical models are based on the analysis of data to index conditions or responses or to develop general relationships that do not require an extensive and detailed data base to operate. Further, they usually have a broader base of application than the physically based model. As such, empirically based models are used extensively in natural resource management and planning. The most commonly used empirical erosion prediction model in natural resource management, the Universal Soil Loss Equation (USLE), was originally developed by Wischmeier and Smith (1965). The USDA Forest Service has developed a modified version of the USLE, the Modified Soil Loss Equation (MSLE), for use in wildland situations (USDA-FS 1980). The MSLE was implemented to model erosion for the proposed Ruby A Federal No. 1-9 Exploratory Oil/Gas Well Project EIS.

Application of the MSLE requires several fundamental assumptions: 1) erosion occurs as a result of raindrop, sheet, or rill erosion and not gully erosion; 2) the eroded material is retained on the site (i.e., transport of eroded materials is not considered); and 3) erosion is in response to rainfall. The MSLE model is a multiplicative function of four factors that are ratios of the total possible erosion that would occur from a standard plot. A standard plot is defined as an area 72.6 feet long by 6 feet wide with soil in a cultivated continuous fallow condition tilled up and down a 9 percent slope. These factors include rainfall erosivity, soil erodibility, length and slope gradient of the location of interest, and vegetation management as indicated in Equation (1):

$$A=R*K*LS*VM \qquad (1)$$

where:

A = soil loss (tons/acre/year)
R = rainfall factor
K = soil erodibility index
LS = length slope factor
VM = vegetation management factor

Rainfall (R) Factor. The annual rainfall factor R, or rainfall erosivity, is an index of the cumulative annual erosive power of rainfall represented by the number of erosion index units associated with an area's mean annual rainfall. The R factor is defined and computed using Equation (2):

$$R = EI/100 \qquad (2)$$

where:

E = the total kinetic energy in foot-tons/acre inch of rain for each storm.

I = the maximum 30-minute intensity in inches/hour for the area, over the same time period used for estimating soil loss.

The annual R factor for the region encompassing the project area was determined to have a value of 20 (Israelsen et al. 1980). Since R is derived from a probablistic analysis of rainfall duration and intensity, its use in the MSLE should not be considered as a precise estimator of soil loss. The R factor's greatest utility lies in its use as a relative index for average rates of erosion. Seasonal and individual storm R values can be derived and applied for estimation of soil loss, although such were not used here.

Soil Erodibility (K) Factor. The soil erodibility factor K represents the inherent ability of the soil to resist the erosive forces associated with raindrop impact and overland sheet or rill erosion forces. The soil erodibility factor is independent of slope and dependant upon soil particle size distribution, structure, void space, pore size, and the percent organic matter. In this analysis, K was derived from an analysis of soil samples obtained during the soil survey performed for the EIS (Appendix A-1). Soil properties derived from laboratory-analyzed soil samples were used in the following equation for the prediction of the soil erodibility factor K (USDA-FS 1980):

$$K = \left[(2.1*10^{-6})(12-Om)(M^{1.14})\right] + \left[0.0325(S-2)\right] + \left[0.025(P-3)\right] \quad (3)$$

where:

Om = percent organic matter
M = (% silt + % very fine sand)(100 - % clay)
S = structure code
P = permeability code

K factors derived from this equation were obtained for each soil type (series) and horizon and adjusted for coarse fragment contents in the soil by the following equation:

$$K = K(\text{calculated}) * 1.18e^{-0.03X} \quad (4)$$

where: X = Percent (by volume) total coarse fragments.

Length-Slope (LS) Factor. The length-slope (LS) factor provides a numerical estimate of the interaction between length and slope of a given segment for determining soil loss. The LS factor in this analysis was calculated from the following relationship (Israelsen et al. 1980):

$$LS = \left[(L/72.6)^{0.5}\right] * \left[\left(\frac{65.41\ s^2}{s^2 + 10{,}000}\right) + \left(\frac{4.56\ s}{(s^2 + 10{,}000)^{0.5}}\right) + 0.065\right] \quad (5)$$

where:

L = length of an individual slope segment
S = segment slope in percent

Vegetation Management (VM) Factor. The vegetation management (VM) factor represents the composite of the effect of protective vegetation and soil surface condition on soil erosion. These are the components that typically are manipulated or modified during a change in management or implementation of a proposed development. Changes in these components may include revegetation, mechanical manipulation of the soil surface (i.e., compaction, loosening, roughening), chemical treatments, and application of mulches. The VM factor does not include erosion control structures such berms, dikes, or water bars, which are accounted for in the LS factor in the form of the length of slope segment. VM factor values were selected from published tables (USDA-FS 1980) based on observations on revegetation success (percent vegetative cover) and soil surface condition of sites in the region. The observations provided a realistic basis for choosing VM factors that would represent a worst-case scenario and a scenario where best management practices were implemented as described in greater detail in a following section. VM factors change in time as vegetation grows and vegetative and litter cover increase. Although the actual relationship between VM factor and time was unknown, the VM factor was assumed to vary linearly over a five-year period and then to remain constant for the remaining period of analysis.

Table 1. Vegetation management (VM) factors utilized for the respective evaluation of erosion control measures.

Erosion Control Measure	Year 1	2	3	4	5
Worst Case:	0.900	0.725	0.555	0.375	0.200
Water Bars:	0.100	0.078	0.055	0.033	0.010
Revegetation:	0.100	0.078	0.055	0.033	0.010
Best Management Practice:	0.100	0.078	0.055	0.033	0.010

Assumptions made in the worst case were that all vegetation would be removed and no active erosion control or revegetation efforts would be implemented. Therefore, the soil surface was assumed to be initially equivalent to a bare soil that is irregular, rough, and tracked in all directions. Although no active revegetation efforts were assumed, the disturbed sites would partially revegetate naturally in time. Similarly, the soil would naturally stabilize through surface crusting and reaggregation. This natural response was accounted for by altering the vegetation management factor over the five-year period to simulate these natural changes. Table 1 lists the VM factors chosen for the worst-case scenario for both the graded and non-graded condition. It was also assumed that water bars would not be constructed under this case.

Best management practices were assumed to include a site-specific reclamation plan involving topsoil salvage and replacement; seed mix design for a specific set of

environmental characteristics and optimal revegetation within five years; fertilizer application; and erosion control including mulching, netting, and water bar construction at optimum spacing. Initial condition of the disturbed site was assumed to be equivalent to a mulch cover of approximately 90 percent, with the mulch either crimped into the soil or held down by netting or chemical tackifier. The applied seed would germinate and grow such that successful revegetation was attained by the fifth year after site disturbance with soil erosion stabilized to a base level. As discussed above, the change in condition of the disturbed site over five years was accounted for within the MSLE by changing the vegetation management factor over this period. Table 1 lists the VM factors chosen for the BMP. Water bars would be constructed at optimal spacing as soon after seeding as possible. Placement of water bars would reduce the length-slope factor resulting in reduced erosion. The assumed optimal spacing of water bars is presented in Table 2. Homogeneous slope segments were subdivided based on the water bar spacing presented in Table 2.

Table 2. Optimal water bar spacing interval for length-slope (LS) factor manipulation used in erosion control.

Slope Gradient (Percent)	Maximum Interval Between Water Bars
10	150 ft.
15	100 ft.
20	50 ft.
30	30 ft.
40	25 ft.
50	20 ft.
>50	15 ft.

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WATER RESOURCES

WATER RESOURCES TECHNICAL REPORT

Prepared For The

Ruby A Federal No. 1-9 Exploratory Oil/Gas Well Project

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December 1988

MITIGATION AND MONITORING

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WATER RESOURCES TECHNICAL REPORT

INTRODUCTION

The following technical report provides site-specific information on the water resources environment of the Phillips Petroleum Company's proposed Ruby A Federal No. 1-9 Exploratory Oil/Gas Well project, an analysis of the potential impacts that could occur if the project were implemented, as well as mitigation measures recommended to reduce adverse impacts. The WATER RESOURCES Sections of the Draft Environmental Impact Statement were prepared based on this information.

Alternative A (Proposed Action) - Ruby Creek Drill Site and Access Route

Phillips proposes to directionally drill a 12,520-foot exploratory oil/gas well on the Beartooth Ranger District, Custer National Forest, Carbon County, Montana. The drilling proposal is located in the Ruby Creek drainage, a tributary to the Clarks Fork of the Yellowstone River. The drill site is located in the NW1/4 NW1/4 Sec 15, T9S, R20E. Access to the proposed site would utilize 4.3 miles of Montana State Highway 72 south from Belfry, Montana, to Grove Creek Road, an existing improved county road. From this point, access would head west towards the drill site, utilizing 5.0 miles of Grove Creek Road and approximately 8.0 miles of existing unimproved "two-track" roads to the Custer National Forest boundary (Forest boundary).

Access to the Forest boundary would traverse BLM-administered land and land under private ownership. From the Forest boundary, access would utilize approximately 0.8 miles of unimproved two-track road to its terminus. To reach the drill site from this point would require approximately 0.3 miles of new road construction. Phillips proposes to construct a 1.7-acre drill pad. Disturbance associated with this alternative would include 21.3 acres of existing road reconstruction (two-track), 1.5 acres of new road construction, a 1.7-acre drill pad, and 0.8 acres of cut and fill slopes and topsoil stockpile associated with the drill site. Total disturbance would be 25.3 acres.

Alternative A Access Route Variations

To assist in the FS and BLM decision-making process, three access route variations to the proposed drill site (Alternative A) were considered in the analysis of this alternative. The purpose of the analysis is to provide a contrast in management opportunities and environmental impacts that would assist the agencies in the decision-making process. These variations are summarized in the following sections.

Proposed Action (Variation A1)

This variation is Phillips' proposed access route to the Ruby Creek drill site described previously.

Meeteetse Trail - Robertson Draw Access Route (Variation A2)

The Meeteetse Trail - Robertson Draw Access Route variation follows the county improved Grove Creek Road to its terminus for 5.0 miles from Montana Highway 72. From the end of the Grove Creek Road, this access route follows unimproved two-track roads for approximately 1.1 miles to the Meeteetse Trail road and then follows this

road for approximately 5.1 miles to its convergence with the Robertson Draw Road. From this point the access route follows the Robertson Draw Road for 5.7 miles to a point where an unimproved two-track road heads north toward Mill Draw. The access route follows this two-track road to Mill Draw where it converges with Phillips' proposed access route. From this point, this access route variation is identical to Phillips' proposed access route. This variation would involve 5.0 miles of the improved county Grove Creek Road requiring no reconstruction, 10.8 miles of improved county road (Meeteetse Trail and Robertson Draw Road) requiring minor reconstruction, 6.8 miles of unimproved two-track road requiring major reconstruction, and 0.3 miles of new road construction.

Southern Access - Robertson Draw Access Route (Variation A3)

The Southern Access - Robertson Draw Access Route variation would originate from Montana Highway 72 approximately 2.2 miles north of the Wyoming border. The access route follows a county road for 1.5 miles across the Clarks Fork to the Robertson Draw Road. From this point access to the drill site would be identical to the Meeteetse Trail -Robertson Draw Access Route (Variation A2) described previously. This variation would involve 1.5 miles of county improved road requiring no reconstruction, reconstruction or new construction of the bridge over the Clarks Fork, 5.7 miles of improved county road (Robertson Draw Road) requiring minor reconstruction, 5.7 miles of unimproved two-track road requiring major reconstruction, and 0.3 miles of new road construction.

Clark Wyoming Access Route (Variation A4)

The Clark Wyoming access route variation originates from Wyoming Highway 120 approximately 8.6 miles south of the Montana border. From this point the access route follows an improved county road for approximately 2.0 miles towards Clark, Wyoming, to an intersection with county road 8WC where the route turns north along this road for 2.4 miles to the intersection with county road 8VC. The access route follows this road west for approximately 0.5 miles to an intersection with a graded dirt road heading north to the Joanne Ranch. The access route heads north on this route for 6.1 miles along unimproved two-track roads to the Robertson Draw Road where this access route converges with Variations A2 and A3 and then follows Variation A2 and A3 routes to the drill site. This variation would involve 7.6 miles of county improved road requiring no reconstruction, 10.1 miles of unimproved two-track road requiring major reconstruction, and 0.3 miles of new road construction.

Alternative B - Gold Creek Drill Site and Access Route

The Gold Creek drill site is located in the Gold Creek drainage in the SW1/4 NE1/4 Sec 10 T9S R20E. Access to this site would utilize the same route as described under the proposed action to the terminus of Grove Creek Road. From that point, access would head west utilizing existing unimproved two-track roads leading to Gold Creek for 5.3 miles to an abandoned drill site. An additional 0.9 miles of new road construction would be required to access the drill site from this point, of which 0.5 miles would occur on Forest land. A 2.2-acre drill pad would be constructed at the Gold Creek drill site. Disturbance associated with this alternative would include 12.9 acres of

existing road reconstruction (two-track), 4.4 acres of new road construction, a 2.2-acre drill pad, and 0.8 acres of cut and fill slopes and topsoil stock pile associated with the drill site. Total disturbance would be 20.3 acres.

AFFECTED ENVIRONMENT

Introduction

The project area lies in several intermittent to perennial stream watersheds on the east side of the Line Creek Plateau including Grove, Dilworth, Gold, Ruby, and Mill creeks. All surface drainage is east to the Clarks Fork of the Yellowstone River. Due to its mountainous location and high elevation, the project area receives the majority of its precipitation in the form of snow from November through April. Thunderstorms provide a moderate amount of additional precipitation during the remainder of the year. Although the project area lies in a precipitation shadow on the east side of the Line Creek Plateau and Beartooth Mountains, the higher elevations (8,000 to 9,000 feet) of the project area receive an annual average of approximately 30 to 40 inches of precipitation while lower to mid-elevations (4,000 to 8,000 feet) receive 20 to 30 inches of precipitation (USDA-FS 1978). The upper reaches of the project area receive an average annual maximum snow accumulation of up to 60 inches and an average maximum snow water equivalence of 20 inches, which generally occurs in April (USDA-FS 1977, 1978 and USDA-SCS 1983). The lower portion of the project area receives considerably less snowfall.

Surface Water

There is minimal information on surface water resources in the project area. None of the streams previously listed have been or are currently gaged. The closest gages are on Rock Creek near Red Lodge and on the Clarks Fork of the Yellowstone River. The streams in the project area are intermittent in space; that is, certain reaches of the same stream contain perennial flow while others do not. Most of the flow contained in the streams is the result of base flow from the inflow of groundwater and springs. The flow regimes of the streams in the project area are relatively placid in that there is little variation in the quantity of flow during the year. The minimal flow variations during the year are in response to snowmelt as well as from rainstorms. Snowmelt commences in mid-April and continues through June. Peak flows generally occur in mid-May to early June in response to snowmelt (USDA-FS 1978). Baseflows resulting from groundwater inflow occur from September through March. Other increases in streamflows occur in response to thunderstorms primarily during the summer and fall months.

There are no comprehensive water quality data for the streams in the project area. USDA-FS (1978) indicates that both Ruby and Gold creeks are medium hard (i.e., 61 to 120 mg/l $CaCO_2$) while Line Creek is hard (over 120 mg/l). Although Ruby and Gold creeks are perennial in the upper portion of the project area, their flow characteristics are not conducive to a game fishery. Since the headwaters of the streams are located at relatively high elevations in areas that have not been adversely affected by management or development, water quality is expected to be good to excellent for

culinary, livestock, and agricultural uses. Water quality data for the Clarks Fork (USDI-USGS 1986) indicate few or no problems with surface water relative to these uses.

According to the Montana Department of Fish, Wildlife and Parks (MDFWP), there are no records of these streams containing game fish (Darling 1989). Within the perennial reaches of these streams, flow discharges range from 0.5 to 1.0 cubic feet per second (cfs). This minimal flow combined with relatively high channel gradients, large cobbles and boulders, and high flow energies minimize potential fishery habitat. Further, these perennial reaches do not have surface water communication with the Clarks Fork, which is considered a good fishery, thereby precluding fish migration from the Clarks Fork to Ruby and Gold creeks.

Groundwater

Similar to surface water, there is minimal information on groundwater resources within the project area. Groundwater is expected to be contained within most of the geologic strata in the area and also in alluvium associated with streams. Except for the alluvium, minimal quantities of groundwater likely occur in the massive and unfractured granitics of the Line Creek Plateau and the upturned sedimentary rocks on the plateau's eastern margin. Where groundwater does occur within these units, it is likely restricted to fracture zones and faults. Springs and seeps typically occur where these features intersect the land surface. Relatively large quantities of easily extracted groundwater are contained in the alluvium associated with the streams in the area, as well as the glacial outwash plains. Groundwater quality is likely to be good to excellent relative to culinary, livestock, and industrial uses.

The hydrogeologic characteristics of the sedimentary units below the surface of the project area are not specifically known. The occurrence of aquifers and groundwater can be highly site-specific both vertically and laterally within the predominantly sedimentary units. All or portions of all units could potentially contain groundwater of varying quantities, yields, and quality.

Water Rights and Claims

There are numerous surface water and groundwater rights and claims in the project area. According to Kuehn (1988), the State of Montana is currently undergoing a general adjudication of existing (pre-July 1, 1973) rights; therefore, the legal nature of each claim or right is uncertain. There are approximately 23 surface water rights and 15 groundwater rights located in the project area, primarily in its eastern portion. Most of these are for stock and wildlife watering, irrigation, and domestic uses. Most of the surface water rights are on Grove Creek with some on Gold, Ruby, and Mill Draw creeks. Many of the groundwater rights are on existing springs such as Tolman Cemetery Spring, Corner Spring, and Three Corner Springs. The several wells in the project area obtain groundwater from the relatively shallow alluvial aquifers contained in the glacial outwash and along stream courses.

Alternative A - Proposed Action

Access Route

Access to the drill site would utilize the existing improved Grove Creek Road for five miles. This road crosses Grove Creek. From the end of the county road, access would utilize unimproved roads to the Forest boundary that cross several unnamed intermittent and ephemeral stream channels, including Dilworth Creek and tributaries to Mill Draw Creek.

Approximately 1.2 miles east of the Forest boundary, the access road converges on Ruby Creek. The road parallels Ruby Creek adjacent to but out of the riparian zone for approximately 2.0 miles. This segment of Ruby Creek contains perennial flow and has a well-developed riparian zone as described in the Vegetation Section. The stream is incised approximately 5 to 15 feet below its floodplain and therefore has steep banks. Most of the riparian vegetation is contained within the incised banks. The channel bed consists of gravels, cobbles, and small boulders up to 18 inches in diameter. The average channel gradient is approximately 10 percent. As discussed previously, the stream has a relatively placid flow regime as evidenced by vegetation covered banks down to the water level associated with base flow conditions and by moss covered rocks and debris within the active channel. The stream is supported by small seeps and springs along its course as well as from groundwater inflow from shallow alluvial aquifers. The existing unimproved road crosses Ruby Creek once with a low water crossing approximately 0.3 miles above the Forest boundary. The road parallels the northern fork of the stream above this crossing. During early October 1988, the stream at this point was observed to flow with approximately 0.5 cubic feet per second (cfs). As indicated previously, peak flows do not appear to significantly exceed baseflows since the source of the stream is primarily groundwater inflow. Most surface water generated from snowmelt quickly percolates into the highly permeable alluvial and glacial deposits contained in the Ruby Creek canyon.

There are three water right claims along Ruby Creek just below the Forest boundary. These include two wells (Norman Frisbie, owner) and one surface water diversion from Ruby Creek (Sun Dial Land Company, Inc.) all located in the N1/2 Sec 14 T9S R20E.

In addition to the proposed access route, three access route variations to the proposed drill site have been identified by the BLM and FS for consideration. Transportation Access route Variation A2 would utilize the county Grove Creek Road to its terminus, and cross Grove Creek as described previously. From the Gold Creek Road terminus, the route ties into the Meeteetse Trail road and follows this road to the Robertson Draw Road. The Meeteetse Trail road crosses the intermittent Dilworth Creek and Mill Draw within one mile of the Clarks Fork river. The route follows the Robertson Draw Road for approximately five miles. This improved county road closely parallels an unnamed ephemeral to intermittent stream for this distance. This route follows an unimproved two-track road to Mill Creek where the route converges with the proposed access route (Variation A1). Several small ephemeral channels would be crossed on this segment of unimproved two-track road. Variation A2 follows the same route as Variation A1 to the proposed drill site from this point of convergence.

Access route variation A3 would utilize 1.5 miles of a county improved two lane road from Highway 72 to the Robertson Draw Road. This segment of the route crosses the

Clarks Fork by a steel truss bridge. The rest of this variation would utilize the same route as described for Variation A2. Access route Variation A4 would utilize paved Park County roads and unimproved two-track roads to access the Robertson Draw Road. This segment of the route crosses the perennial Bennett and Line creeks. Upon reaching the Robertson Draw road, this variation would be the same as Variations A2 and A3 to the proposed drill site.

Drill Site

The drill site is located on a structural bench or ridge located approximately 250 feet above and 0.25 miles north of the main (south) fork of Ruby Creek. There are no stream channels or drainage ways in the immediate vicinity of the drill site. The site is well-drained with no evidence of shallow groundwater or seeps and springs. The closest water rights to this drill site are located approximately 1.3 miles east, and are the same as discussed for the access route.

Alternative B - Gold Creek Site

Access Route

Access to the drill site would utilize the existing improved Grove Creek Road for five miles as discussed under Alternative A. From the end of the county road, access would utilize unimproved two-track roads that cross and parallel several unnamed ephemeral stream channels to reach the abandoned Amoco drill site. The access route converges and crosses Gold Creek approximately 0.4 miles and 0.8 miles below (east) the abandoned drill site and the Forest boundary, respectively. This upper segment of Gold Creek is very similar to that described for Ruby Creek. Upon crossing the creek, the route then diverges from the creek, traverses upland, and crosses two ephemeral tributaries to Gold Creek upon terminating at the abandoned drill site. From the abandoned Amoco drill site, the access route would again converge on and parallel Gold Creek for approximately 0.3 miles. At one point the access route would lie directly adjacent to the steep banks (70 percent) leading down to Gold Creek for approximately 100 feet. At this point the access route again diverges from Gold Creek and traverses 15 to 20 percent upland slopes to the drill site. The nearest water right to this upper segment of access route is a well in the SW1/4 Sec 2 T9S R20E (Amoco Production Company, owner).

Drill Site

The drill site is located on a 15 to 20 percent hill slope with undulating topography covered with ground moraine. The site is approximately 0.2 miles north of Gold Creek. Several small swales that show no evidence of recent surface water flow traverse the drill site area. The site is well-drained with no evidence of shallow groundwater or seeps and springs. The closest water right to this drill site is located approximately one mile northeast and is the same as discussed for the access route.

ENVIRONMENTAL CONSEQUENCES

Introduction

Impacts associated with drill pad and access road construction include the removal of vegetation, exposure of the soil surface, and compaction of the soil with resultant increases in overland flow and subsequent erosion and off-site sedimentation. These changes could create the potential for increased streamflow, increased stream sedimentation, and subsequent degradation of water quality below standards if they were not appropriately controlled or they occurred in close proximity to a stream. The magnitude and duration of these impacts depend on several factors, including slope aspect and slope gradient, degree and area of soil disturbance, susceptibility of soil to erosion, and proximity to established drainage channels. The duration of time within which construction activities take place and the timely implementation of and success or failure of mitigation measures applied would also be factors. These potential impacts would be greatest soon after the commencement of construction activities but would naturally decrease shortly after due to passive stabilization and implementation of erosion and sediment control measures.

Minor stream channel disruption could occur where access road construction or reconstruction crosses streams. Channel disruption could include alteration of channel configuration, gradient, or bed texture and subsequent changes in aggradation/-degradation regime.

Water would be used during road and drill pad construction and would likely be obtained and trucked from authorized water sources in the project area. The quantity and rate of water withdrawal would be minimal and appropriate state permits would be obtained. The quantities of water used would be minimized so that the impact to water resources would be minimal.

The leakage or spillage of the small quantity of fluids contained in the cuttings trench could degrade surface and groundwater. The potential of such an impact occurring would depend on the quantity released and the proximity to the water body potentially impacted. However, the cuttings trench would be lined with a synthetic impermeable liner that would preclude leakage. Reject and spent drilling fluids would be transported to an approved disposal site out of the project area. Spillage of petrochemicals associated with construction or operation of the project could also impact both surface and groundwater if released in close proximity to streams. Groundwater contamination could occur from well construction or operation due to the leakage of drilling fluids into groundwater or due to the mixing of groundwater of differing quality from different aquifers. Groundwater, oil, and gas may occur under high pressure that, upon being penetrated during well drilling, could migrate laterally along geologic strata or vertically along the outside of the well casing to areas of lower pressure. Contamination could reach surface water in areas at or below seeps, springs, or significant groundwater outflow.

To prevent these potential impacts from occurring, Phillips proposes to minimize all impacts to water resources through implementation of best management practices presented in several information sources including the USDA-FS Region 1 Soil and Water Conservation Handbook (FS Handbook 2509.22), and the joint BLM and FS

"Gold Book" or Surface Operating Standards for Oil and Gas Exploration and Development (USDI-BLM and USDA-FS 1988). These information sources were used to prepare a site-specific erosion control, revegetation, and rehabilitation plan for the project. This plan is presented in Appendix D of the DEIS.

The following criteria were used to determine the significance of impacts to water resources due to the proposed action or alternatives:

General:

- Implementation of the proposed action or alternatives would violate forest wide management direction and/or management area direction as described and mandated by the Custer National Forest LRMP and EIS (USDA-FS 1986) and the Billings Resource Area RMP (USDI-BLM 1983).

Surface Water:

- Degradation of water quality such that state and/or federal standards are not met.
- Modification of the quantity or quality of stream flows that affects established users such as humans, livestock, fish, and wildlife.
- Alteration of channel geometry or gradients producing undesirable effects such as aggradation, degradation, or side cutting.
- Location of permanent above-ground facilities within the 100-year floodplain of a stream.
- Downstream sedimentation that affects the operation of irrigation and domestic water control structures.

Groundwater:

- Degradation of groundwater quality of aquifers directly utilized through wells or that discharge into water bodies utilized for irrigation, domestic use, and wildlife and fisheries.
- Increase or decrease of water table levels caused by construction or operation of the proposed project.
- Interception of shallow water table resulting in slope instability.

Direct and Indirect Impacts

Alternative A - Proposed Action

Access Route

Impacts that would occur due to access road reconstruction and construction would be minimal. A slight increase in erosion and off-site sedimentation would occur due to reconstruction of existing two-track roads to the Forest boundary; however, the quantities would be minimal in the short-term and non-existent in the long-term.

Water for use during road construction would be obtained from a state-approved and permitted source. It is likely that the necessary water would be obtained from the Clarks Fork. The rate and quantity of withdrawal would be minimized to avoid de-watering the river. The water would be trucked to the site of application. Upon termination of road construction, exposed soil would be quickly stabilized and protected, and efficient runoff and drainage control structures would be constructed along the permanent portion of the road as described in Appendix D of the DEIS to minimize impacts to levels not considered significant. All drainage crossings would be designed and constructed to facilitate 50- to 100-year channel flows following standard engineering procedures. Most of the existing channel crossings would be upgraded to a more environmentally sound design. Approximately 1.2 miles of existing unimproved two-track road that parallels Ruby Creek would be reconstructed. This route is located above and out of the stream environment (i.e., 100-year flood plain). A relatively dense zone of vegetation (80 percent) 50- to 75-feet wide consisting primarily of sagebrush, grasses, and forbs occurs between the access route and the riparian zone and creek. This, combined with mild slope gradients (10 to 20 percent) oriented parallel to the stream rather than normal to the stream; and runoff and erosion control as specified in Appendix D of the DEIS would greatly minimize the potential of increased sedimentation of Ruby Creek. As indicated previously, road reconstruction would likely reduce the levels of erosion and sedimentation below that which is currently occurring from the unimproved two-track road through implementation of efficient runoff and erosion control structures.

Construction of 0.3 miles of new road to the drill site would similarly result in minimal impact to water resources. Best management practices would minimize impacts, including efficient runoff and erosion control within the road environment, as described in Appendix D of the DEIS. There is sufficient upland vegetation between road construction and the stream such that when combined with runoff and erosion control, minimal increase in sedimentation of Ruby Creek would occur. Construction of the culverted stream crossing could cause a minor increase in sedimentation of Ruby Creek in the short-term; however, no long-term impacts of significance are anticipated since best management practices would be used to construct and place the culvert. Placement of a culvert would reduce channel disruption and increased sedimentation from the existing condition since the low water crossing would be eliminated. Successful reclamation of the new access road is feasible as discussed in the Soils and Vegetation Resources technical reports. If producible quantities of oil or gas were not encountered, the drill site would be abandoned and reclaimed, and the new access road from the Forest boundary to the drill site would be recontoured and reclaimed. If producible quantities were encountered, the cut and fill slopes of the new road would be secured for a two- to three-year interim period while additional environmental analysis (i.e.,

environmental assessment and/or environmental impact statement) were conducted and the FS and BLM reached a decision concerning well production and field development.

The cut and fill surfaces of the road would be secured from erosion and surface runoff through mulching, netting, matting, and/or revegetation depending on site-specific conditions. Similarly, all runoff, drainage, and erosion control structures would be monitored and maintained in functional condition. No significant impacts due to erosion and sedimentation from the reclaimed road are anticipated since the site-specific, erosion control, revegetation and rehabilitation plan presented in Appendix D of the DEIS would be implemented.

During project construction and operation, there would be a small chance for spillage of oil or other products from trucks. The design and implementation of chemical spill prevention and containment plan pursuant to Section 11.07 of the FS Handbook 2509.22 would greatly reduce impacts that could occur in the unlikely event of a spill.

Although minor adverse impacts to water resources would occur due to access road construction, operation, and reclamation, these impacts would not be considered significant relative to degradation of surface and groundwater, modification of surface water flow or groundwater levels, construction within a 100-year floodplain, downstream water control structures or water rights, or slope stability problems due to interception of shallow groundwater.

No significant impacts are anticipated to occur due to implementation of any of the Alternative A routing variations. The type and magnitude of impacts would be similar to those described previously for Phillips' proposed access. Since each variation would involve implementation of best management practices to minimize erosion to levels not considered significant, there would generally not be a substantial difference in the adverse impacts due to any of the variations. Implementation of Variation A2 or A3 could reduce the amount of existing erosion along improved roads by constructing more efficient and effective drainage control structures. Construction of a new bridge or reconstruction of the existing bridge over the Clarks Fork could temporarily impact the river through bank disturbance.

Drill Site

Construction of the drill site would likely not cause a significant increase in surface runoff and erosion since the implementation and correct placement of runoff and erosion control measures such as soil surface stabilization with mulches and revegetation, interception ditches, waterbars, berms, water turnouts, energy dissipators, and sediment traps would control surface runoff and minimize erosion to tolerable levels. These measures, combined with the 0.25-mile distance to Ruby Creek, would minimize the potential for contamination of the creek and subsequent reduction of water quality. No stream channels, drainage channels, floodplains, seeps, or springs would be impacted by construction and operation of the drill site.

Phillips proposes to use a closed mud system for well drilling. This system requires a substantially reduced water requirements and storage capacity for drilling wastes and cuttings. The cuttings trench would be constructed in bedrock cut, which would provide more than adequate structural strength, thereby minimizing the potential of trench failure and subsequent spillage. Leakage of liquids would be possible; however, a

properly installed synthetic liner would minimize the potential of leakage and subsequent contamination of groundwater or Ruby Creek. Trench overflow could potentially occur during or following drilling due to heavy rains or snowmelt. Over-design of the trench, or utilizing a maximum of 75 percent of its capacity for drilling wastes and the balance for direct precipitation and runoff, would minimize the potential for overflow. As indicated previously, the well would be cased with pressure tested steel pipe. The annulus, or void space between the outside of the casing and the drill hole, would be filled and sealed with cement. Upon well abandonment, the well casing would be left in place and plugged according to state and federal regulations. These measures would minimize the potential of contamination of groundwater or aquifers encountered during drilling. Hydraulic fracturing of deep geologic strata during well drilling is unlikely; however, this technique may be utilized for well testing purposes.

Phillips proposes to construct a water well on-site to supply water for the drilling program. Water requirements are expected to be relatively small (1.3 acre-feet or 420,000 gallons) due to the reduced water requirements of a closed mud system. A groundwater appropriation permit would be required from the Montana Department of Natural Resources and Conservation for the groundwater used in conjunction with drilling activities. The construction and use of such a well would not significantly impact groundwater quality or quantity or impact any nearby groundwater rights or claims. The quantity of groundwater withdrawn from the underground reservoir would be relatively small compared to the total quantity of groundwater in the underlying rock units. The rate of water withdrawal would be reduced so that there would not be a short- or long-term reduction in the watertable. If groundwater was not encountered at the drill site, Phillips' next best option would entail drilling a shallow well along the access road on the alluvial bottomlands of Ruby Creek south and below the drill site. Water would be trucked to the drill site rather than moved by pumping and pipeline conveyance. The quantity and rate of withdrawal would be small compared to the quantity and rate of supply of groundwater in the alluvial aquifer in the Ruby Creek drainage. Since the groundwater would not be impacted, Ruby Creek would likely not be impacted by flow reduction.

An additional possibility for a water source includes constructing a small impoundment on the headwaters of Ruby Creek in close proximity to the drill site. Ruby Creek flows at an approximate mean annual rate of less than 0.5 cfs in the vicinity of the drill site. The 1.3 acre-foot water requirement would necessitate an impoundment of at least 0.5 acres in size depending on the timing and duration of water withdrawal. If such an impoundment were used, water would also be trucked to the drill site. This impoundment could adversely affect downstream water rights as well as in-stream uses by wildlife and aquatic insects by reducing streamflows. Any reduction in streamflow would be temporary. A water appropriation permit from the Montana Department of Natural Resources and Conservation would be required to authorize surface water withdrawal. In addition, construction of the impoundment would cause additional disturbance of the riparian zone and increased sedimentation of Ruby Creek.

Similarly as discussed for the access road, the design and implementation of a chemical spill prevention and containment plan pursuant to Section 11.07 of the FS Handbook 2509.22 would greatly reduce impacts that could occur in the unlikely event of a spill at the drill site.

Although adverse impacts to water resources would occur due to drill site construction, operation, and reclamation, these impacts would not be considered significant relative to degradation of surface and groundwater, modification of surface water flow or groundwater levels, construction within a 100-year floodplain, downstream water control structures or water rights, or slope stability problems due to interception of shallow groundwater.

Alternative B - Gold Creek Site

Access Route

Impacts that could occur due to access road reconstruction and construction would be minimal, and would be very similar to the impacts discussed for Alternative A. Water for use in road construction would be obtained from a state-approved and permitted source such as the Clarks Fork and trucked to the site of application. Water would be withdrawn at reduced rates to a reduction in streamflow. Road reconstruction would involve construction and placement of a culvert across Gold Creek. This route is located above and out of the stream environment (i.e., 100-year floodplain) except for a 100-foot segment that converges on steep slopes (70 percent) leading down to the creek where an increase in sedimentation could occur. Relocation of the road away from the stream environment and implementation of best management practices would minimize increased sedimentation of the stream. Except for this segment, the relatively dense zone of vegetation (80 percent) 50 to 75 feet wide that occurs between the access route and the riparian zone and creek, combined with mild slope gradients (10 to 20 percent) oriented parallel to the stream rather than normal to the stream, and runoff and erosion control, would minimize the potential of increased sedimentation of Gold Creek.

As indicated previously, road reconstruction would likely reduce the levels of erosion and sedimentation below that which is currently occurring from the unimproved two-track road through implementation of efficient runoff and erosion control structures.

Impacts associated with the construction, operation, and reclamation of the new access road from the abandoned Amoco drill site to the Alternative B drill site would be very similar to those described for Alternative A. Although minor adverse impacts to water resources would occur due to access road construction, operation, and reclamation, these impacts would not be considered significant relative to degradation of surface and groundwater, modification of surface water flow or groundwater levels, construction within a 100-year floodplain, downstream water control structures or water rights, or slope stability problems due to interception of shallow groundwater.

Drill Site

Impacts to water resources that could occur due to construction, operation, and reclamation of the drill site would be very similar to those discussed for Alternative A. The drill site is located approximately 0.2 miles from Gold Creek; therefore, there is minimal chance for affecting the stream. Although minimal adverse impacts to water resources would occur due to drill site construction, operation, and reclamation, these impacts would not be considered significant relative to degradation of surface and groundwater, modification of surface water flow or groundwater levels, construction within a 100-year floodplain, downstream water control structures or water rights, or slope stability problems due to interception of shallow groundwater. The discussion on

alternative water sources to a water well drilled on-site presented under Alternative A also applies to this alternative. In this case, if groundwater was not encountered at the drill site, Phillips' would construct a water well below the drill site in closer proximity to Gold Creek. The discussion on impacts presented under Alternative A applies to Alternative B. Water would be trucked to the drill site. A groundwater appropriation permit would be obtained from the Montana Department of Natural Resources. A possibility exists of constructing a small impoundment on Gold Creek near the drill site. Such action could significantly impact the creek.

Impacts Summary

No significant impacts would occur to water resources due to implementation of Alternative A or Alternative B relative to degradation of surface and groundwater, modification of surface water flow or groundwater levels, construction within a 100-year floodplain, downstream water control structures or water rights, or slope stability problems due to interception of shallow groundwater. Placement of a water well on the drill site would be preferable to constructing a well off-site or by constructing an impoundment on Ruby Creek or Gold Creek. Increased sedimentation of Gold Creek could occur where reconstruction of the existing road above the abandoned Amoco drill site converges on the stream environment. These potential impacts could be easily avoided by relocating the road 50 to 75 feet north of its present location. Based on the total amount of road reconstruction and new road construction in proximity to a stream, implementation of Alternative B would pose greater potential for impacting water resources than Alternative A. This differential would not be considered significant assuming minor relocation of the Alternative B access road away from Gold Creek. Implementation of either Alternative A or Alternative B would not violate existing management direction as itemized in the Custer National Forest LRMP and EIS (USDA-FS 1986).

Since no anticipated game fisheries occur in Ruby and Gold creeks and since there is no surface water communication between the Clarks Fork and these streams, fishery resources would not likely be impacted. Neither alternative is likely to adversely impact fishery resources of the Clarks Fork.

Cumulative Impacts

Existing land and resource management activities within the project area primarily include grazing on non-Forest lands and road construction and use. These activities and uses have not substantially affected the water resources in the project area. Road construction and use has caused an increase in soil erosion since a portion of cut and fill slopes have not been protected from erosion with revegetation. Further, since most of the roads in the project area are unimproved, drainage and runoff control are sub-optimal, which adds to the increase in soil erosion over natural base rates. Overall, these impacts are not cumulatively significant. Implementation of the proposed project would likely decrease erosion and sedimentation from roads since drainage and runoff control would be improved; therefore implementation of the proposed project would not significantly add to these impacts. Appendix B discusses impacts due to field development and suggests that no significant cumulative impacts to water resources would be expected.

Mitigation Summary

Impacts to water resources could be reduced by minimizing the area of disturbance to that absolutely necessary for construction, operation, and reclamation of the drill site and access road. This is particularly important in close proximity to stream environments. Implementation of the detailed site-specific erosion control, revegetation, and rehabilitation plan (Appendix D of the DEIS) would reduce surface runoff, erosion, and off-site sedimentation from all disturbed areas. The plan includes the use of interception ditches, sediment traps, water bars, silt fences, as well as revegetation and soil stabilization techniques to minimize impacts. Specifically for the drill site, an interception ditch would be constructed along the top of all cutslopes to preclude surface water from entering the drill pad area as well as a berm surrounding the pad along all fill areas to preclude runoff. These structures would be inspected periodically for integrity and efficient operation. The plan includes annual monitoring and identification/implementation of remedial measures if determined to be necessary.

State-of-the-art well casing and cementing technology would minimize contamination of groundwater during well drilling and well operation. This technology includes casing the well during drilling and cementing the annulus between the casing and wellbore. The cuttings trench should be designed such that only 75 percent of total capacity is utilized, leaving the balance as a buffer to hold direct precipitation and runoff. A synthetic membrane liner of sufficient thickness to minimize puncture or fatigue should be placed within the trench to minimize the potential of leakage.

All water withdrawal (i.e., surface water and groundwater) and use should comply with state law. This includes obtaining instream diversion rights and groundwater allocation permits.

The quantity and rate of water withdrawal should be minimized to reduce the potential of depleting the groundwater resource and/or reducing in-stream flows.

The design and timely implementation of a chemical spill prevention and containment plan pursuant to Section 11.07 of FS Handbook 2507.22 would greatly reduce impacts that could occur in the unlikely event of a spill at the drill site or along the access road.

If Alternative B is implemented, the access route in close proximity to Gold Creek should be relocated approximately 50 to 75 feet north of the existing trail to avoid the potential of increasing sedimentation of the creek.

Unavoidable Adverse Impacts

With implementation of the mitigation measures summarized above, the specific mitigation items presented in Chapter 5; and the measures presented in Appendix D of the DEIS, no unavoidable adverse impacts would occur to water resources under either alternative.

Comparative Analysis

Construction and operation of access roads adjacent to the stream environment is unlikely to cause increased erosion and subsequent sedimentation in Ruby and Gold creeks since runoff and erosion would be controlled on all disturbed areas. Contamination of surface water by spilled fuel or drilling fluid, and contamination of freshwater aquifers by drilling fluids or mixing of groundwater are unlikely to occur since a spill prevention and control plan as well as state-of-the-art drilling techniques would be implemented to minimize these potential impacts. Fisheries would not be impacted since neither Ruby nor Gold creeks contain suitable habitat. Existing water rights and claims in the project area would not be impacted.

Both alternatives involve crossing small perennial streams at existing crossings. Important impact contrasts between Alternative A and Alternative B include 0.02 acres of road construction within the stream environment for Alternative A compared to 0.03 for Alternative B and 1.2 miles of road construction paralleling, but out of, the stream environment for Alternative A compared to 0.4 miles for Alternative B. Alternative B access route converges on a steep 70 percent sideslope down to Gold Creek that could involve fill reaching the stream. To avoid significantly impacting Gold Creek, the access route should be relocated 50 to 75 feet north. Assuming that relocation of this segment of road would be implemented, there is no major difference between the alternatives. The types and magnitude of impacts would be similar for each of the Alternative A route variations. Variation A3 could impact the Clarks Fork during bridge construction or reconstruction. The proposed project would not violate existing management direction in regard to water resources.

Irretrievable and Irreversible Commitment of Resources

No irreversible and minimal irretrievable commitment of resources would occur to water resources. Water used during project construction and drilling would be temporarily withheld from other uses. As indicated previously the quantity of water used would negligible compared to the quantity of water available for other beneficial uses (i.e., human and other uses such as wildlife). Therefore, the irretrievable commitment of water resources would be short-term and negligible.

MITIGATION AND MONITORING

The mitigation measures and monitoring requirements that follow will be included in the Conditions of Approval for the drilling proposal if project approval is granted. The measures and requirements were developed in response to impacts identified in the Environmental Consequences chapter (Chapter 4) and through issues identified during the scoping process. The measures and requirements describe how drilling will be managed to assure compliance with the resource management goals and objectives of the Custer National Forest Land and Resources Management Plan (USDA-FS 1986), applicable lease stipulations, and resource limitations identified during interdisciplinary analysis. The following measures and requirements apply to Alternatives A and B unless otherwise noted. If deemed necessary in light of new facts or to minimize impacts, the following measures may be added to, modified, or selectively withheld. The

Authorized Officer (AO) will determine final mitigation measures and monitoring requirements after consultation with the interdisciplinary team (IDT), who will have made recommendations based upon on-the-ground situation analysis.

Administrative and Preconstruction

- Conduct all operations in full compliance with applicable laws and regulations and the approved Application for Permit to Drill (APD, which includes the H_2S Contingency and Evacuation Plan).

- Phillips will adhere to applicable lease stipulations during all phases of the proposed drilling activity, or provide for written waiver of the stipulation(s) where adherence is not possible but acceptable with proper mitigation.

- Guide all phases of Phillips' exploratory drilling proposal, including road and drill site construction and maintenance and rehabilitation, by the dictates of the Clean Water Act. Control accidental discharge of all hazardous substances, including fuels, by methods described in a spill prevention and containment plan to be prepared by Phillips. Protect completely all single tanks of 660 gallons or larger and any aggregate of containers totalling 1,320 gallons or more.

- Utilize the Soil and Water Conservation Handbook (FS Handbook 2509.22, May 1988) and the Surface Operating Standards for Oil and Gas Exploration and Development (USDI-BLM and USDA-FS 1988) for reference to best management practices relating to road construction, drill pad construction, containment of drilling fluids and produced fluids and gases, and handling of all products and by-products of oil drilling.

- Phillips will submit for approval an access road design plan using roading guidelines approved for use by the Custer National Forest before starting construction.

- Phillips will submit for approval a road improvement plan for existing roads within the project area intended for use as part of exploratory drilling activities. The road improvement plan will specify road work needed to accommodate exploratory drilling activities. The plan will be agreed to in advance of any road improvement work by Phillips, the Bureau of Land Management (BLM) right-of-way requirements, and the Forest Service (FS). Phillips will schedule a review of this plan a minimum of 14 days in advance of anticipated start work date. Construction, reconstruction, and maintenance activities on county roads in the project area will be in accordance with a Memorandum of Understanding between Carbon County and Phillips.

- Phillips will prepare and submit a comprehensive drill site design plan to the BLM and FS for approval prior to initiation of construction. This plan will show the layout of the drill pad over the existing topography, dimensions of the pad, volumes and cross sections of cut and fill, location and dimensions of the cuttings trench, and access road egress and ingress.

- Phillips will slope-stake all construction activities and receive approval by the FS prior to start of construction.

- Require a qualified inspector to be on-site during all construction and reconstruction activities to assure contractor compliance with approved road and drill site design plans. Phillips will provide the qualified inspector.

Water Resources

- To reduce impacts to water resources, minimize the area of disturbance to that absolutely necessary for construction, operation, and reclamation of the drill site and access road. This is particularly important in close proximity to stream environments.

- Implementation of the site-specific ERRP presented in Appendix D of the DEIS would effectively reduce surface runoff, erosion, and off-site sedimentation.

- State-of-the-art well casing and cementing technology would minimize contamination of groundwater during well drilling and well operation. This technology includes casing the well during drilling and cementing the annulus between the casing and wellbore.

- The cuttings trench should be designed such that only 75 percent of total capacity is utilized, leaving the balance as a buffer to hold direct precipitation and runoff.

- A synthetic membrane liner of sufficient thickness to minimize puncture or fatigue should be placed within the trench to minimize the potential of leakage.

- The design and timely implementation of a spill prevention and control plan would greatly reduce impacts that could occur in the unlikely event of a spill at the drill site or along the access road.

- All stream or channel crossings by access road should be designed for the 50- to 100-year storm event. FS Handbook 2509.22 should be used as a guide in designing all runoff and erosion control structures.

- If Alternative B is implemented, the access route in close proximity to Gold Creek should be relocated approximately 50 to 75 feet north of the existing trail to avoid the potential of increasing creek sedimentation.

- All water withdrawal (i.e., surface water and groundwater) and use will comply with state law. This includes obtaining instream diversion rights and groundwater allocation permits.

FIELD DEVELOPMENT SCENARIO

Well Development

Phillips proposes to drill the Ruby A Federal No. 1-9 Prospect to determine the presence of hydrocarbon reserves and evaluate the commercial potential of the reserves, if encountered, by conducting various tests. These tests would include analyzing drill

cutting samples to detect evidence of oil, drill stem tests to determine more closely the performance of the hydrocarbon reservoir's productive capacity, and electrical log surveys to determine reservoir porosity and presence of oil and/or gas. Depending on the outcome of the testing program, Phillips may choose to permanently plug the well and abandon and reclaim the location, temporarily plug or shut-in the well until decisions are reached regarding future production options, or request approval to enter production operations.

The following discussion describes activities associated with producing this one proposed exploratory well.

Oil Well Development

If the well is an oil producer, several steps would be taken to test, complete, or develop the well. These steps would occur on the well pad and normally include the following actions: installation and cementing of well casing; perforation of the reservoir; installation of production tubing; and installation of control heads (an assembly of valves and gauges called a "Christmas Tree") to regulate the rate of flow from flowing wells, or the installation of a pumping unit or other lifting mechanism to lift oil to the surface in a non-flowing well. Equipment off-site would include installation of a battery of tanks for storing the oil and installation of equipment to separate oil, gas, and water so that the oil meets sales requirements. Segments of the drill pad not needed for production operations would be regraded, topsoiled, and revegetated as per a comprehensive reclamation plan developed by Phillips and approved by the FS/BLM. Cut and fill slopes associated with drill pad construction would be revegetated. The access road to the drill pad and production facilities would remain in place for maintenance and production development purposes.

Initially, if hydrocarbons were encountered, production from the well would be stored at the production facility in tanks and trucked to market facilities. The number of trucks per day would be commensurate with the rate of production encountered. Production operations would require use and maintenance of an access road from the production facility to Montana State Highway 72 on a year-long basis. Maintenance during the summer and early fall months would be typical of graveled road maintenance in the area. Maintenance during the winter months would be relative to the amount of production encountered.

Winter maintenance would include blading or plowing snow from the access road in a manner prescribed in a plan of operations prepared by Phillips and approved by the FS/BLM.

Gas Well Development

Much of natural gas production is associated gas produced with oil. As a result, natural gas production is influenced by oil well development and production practices. There are, however, certain features of gas well development that are specific to gas production. Reservoir pressure is the controlling factor in the ability of a gas well to produce. Estimating the reserves and forecasting production rates and production life are early considerations in determining the economic feasibility of gas well completion and development. Completion of a gas well includes steps comparable to that of an oil well. Casing, tubing, and well head equipment are selected on the basis of flow rates,

fluid erosion, and chemical corrosion. Safety shutoff equipment is more critical and must meet higher design standards. Compressors may be needed to help the gas enter the pipeline if the well producing pressure at the surface is less than pipeline pressure. In either case, safety and flow regulator valves are installed at the well head. The equipment and fittings must meet standards set by the American Petroleum Institute (API) following sizes and ratings established by the American National Standards Institute (ANSI) if corrosive conditions are expected.

Based on what Phillips knows of the geology of the area, their targeted formations described in the APD, and the negligible quantities of gas encountered during previous drilling attempts by other companies in the area, Phillips does not expect to encounter gas during the drilling of this exploratory well. If non-producible quantities of gas are encountered (i.e., not economical to produce), with producible quantities of oil, the gas would likely be flared or vented off as authorized by an approved venting or flaring permit issued by the BLM.

Field Development

Oil and/or gas field development generally requires more than one well to efficiently extract the hydrocarbon reservoirs. Well density and location are designed to efficiently extract the oil/gas reserves based on specific reservoir characteristics, economics, and environmental considerations. Most of the information required to determine appropriate well density and locations is not available until after the reservoir has been penetrated and production characteristics have been established during the exploratory phase. After considering all pertinent information, the well density would be subject to the approval of the State of Montana Oil and Gas Conservation Board and the BLM.

The following discussion regarding development of the Ruby A Federal No. 1-9 Prospect is based on what Phillips currently knows of the geology of the Ruby area from seismic interpretations and established well control data from fields to the northeast and southeast of the prospect area.

Only after exploratory drilling would more complete information regarding the geologic structures of interest be known. Once this geologic information is gained, more concrete determinations regarding the intensity and extent of field development would be made by Phillips. If oil or gas is present in commercial quantities, wells would be completed and production equipment and facilities installed. Development activity might be limited to drilling, plugging, and reclaiming the current drilling proposal or extended to drilling numerous wells from three well sites, with their attendant tank batteries, electric lines, and access roads.

The three proposed well sites are located such that Phillips should be able to reach and develop 80 percent of the leasehold. Because of the structures being drilled and drill site vertical and horizontal displacement limitations, all three well sites would be located on the Custer National Forest. Directionally drilling the Ruby Prospect requires a high vertical elevation location and a limited horizontal distance to the downhole drilling target. The higher elevation allows the vertical space needed to achieve changes in direction for the drill bit. The horizontal distance from the wellbore to the target

must be as short as possible to minimize the angle needed to reach the target. Phillips estimates that moving off-Forest would limit the potential development of these leases to less than 30 percent using conventional directional drilling methods.

Aspects of field development as currently envisioned by Phillips include the following:

- Confirmation Well - If the initial exploratory well encountered hydrocarbons (either gas or oil), an additional exploratory well, called a confirmation well, would likely be drilled to confirm the findings. This well would be drilled from a drill site location approved through the NEPA process. The confirmation well would be directionally drilled to test the extent of the geologic structure in another direction. This well would also help evaluate the hydrocarbon potential of the structure.

- Production Wells - The steep topography of the east face of the Line Creek Plateau and the perceived location of the geologic structure limits the number of suitable well site locations available for field development. As a result, as many wells as feasible would be drilled from each of the three well sites. Phillips estimates that a maximum of six directional production wells could be drilled from each well site, for a maximum of 18 producing wells within the field. Phillips would attempt to complete one production well annually on each of the well sites, for total well development in six years. This estimate assumes few drilling and completion problems. Phillips estimates a range of six to ten years or longer to complete the wells, with allowance for drilling and completion problems. The actual number of wells that could be expected from each well site would be better known following evaluation of the original test well and the confirmation well. Each well site would be equipped with one well head for each producing well and surface piping as needed to operate the method of well pumping utilized. Phillips currently plans to use hydraulic well pumps. These pumps were selected because they are unobtrusive, quiet, and operate on produced oil.

- Production Facilities - One off-site production facility is anticipated for each well site and would be located up to three miles from the well site. Phillips has proposed off-site production facilities to reduce the frequency of required visits to each well site for monitoring and maintenance purposes. Well visits for servicing operations would occur weekly during the winter and spring months. During the summer and fall months, wells could be visited more frequently. The use of automatic shutdown systems and well control from the remote production facilities would preclude the need for daily visits. Well sites would be accessed from the production facilities by enclosed motor vehicle during the winter months. Access roads to the production facilities and the producing well sites would remain open year-round.

  The production facilities would require electrical power, continual access, and numerous pieces of production equipment as described above. Electricity would be brought in to the production facilities either from the north or south by tying into existing power sources. Likely powerline corridors from existing power sources to the production facilities would follow the transportation systems.

Power poles and line configurations would be designed to reduce impacts to raptors. Electricity would be located underground from the production facilities to the well pads.

Phillips plans to install all flowlines, power oil/lift gas, instrument gas, electricity, and heating lines underground in the access road corridor, as needed, from the well sites to the production facilities to operate equipment at the well sites remotely. The number, size, and use of these lines would be determined by the characteristics of the hydrocarbon being produced. Characteristics and behavior of the hydrocarbon reservoir may make necessary changes from one production method to another over the life of the field.

o Pipeline/Transportation - Pipelines for fluids from the wells to the production facilities would be laid within the existing road right-of-way. Pipeline routes utilized from the production facilities to a tie-in with existing pipeline(s) would depend on the product destination (i.e., the purchaser of the product). There are several existing underground pipelines that could be utilized. These pipelines include three Husky lines (2-inch, 3.5-inch, and 4-inch), an Amoco 12-inch line, and a Marathon Oil 6-inch line. These lines are located approximately 12 to 15 miles to the east of the Ruby A Federal No. 1-9 field and generally parallel Wyoming Highway 120 and Montana Highway 72.

Crude oil from the production facilities would be transported to market by pipeline if the volumes produced are large enough to justify the expense of laying the lines. If this justification cannot be made, crude oil would be hauled from the production facilities by tanker trucks and transported to a truck unloading depot where the crude oil would be unloaded into a pipeline leading to a larger interstate pipeline. Production amounts would be monitored by means of a Lease Automated Custody Transfer unit (LACT), or hand gauging.

Pipeline construction would occur in a planned sequence of operations common to oil/gas pipeline installation specifications and would take place along a corridor of continuous activity. All pipeline installation work would be completed by a contractor working under Phillips supervision. An average 50-foot width of disturbance is anticipated.

The actual pipeline location would be surveyed and staked prior to start of construction activities. The pipeline corridor would be cleared of heavy brush prior to earth-disturbing activities. Topsoil would be stripped starting from the center of the corridor, or center line of the trench, and windrowed along the outside edges of the right-of-way (ROW). The route would be graded as necessary for passage of construction equipment.

Subsoil would be removed and stockpiled separately from topsoil. The ditch would be excavated mechanically with ditching equipment. The width of the ditch would vary depending on the size of pipe being laid. For example, the ditch width would be 14 inches for a 4-inch-diameter pipe and 18 inches for a 6-inch-diameter pipe. The ditch would be of sufficient depth to permit a minimum cover of 36 inches over the pipe.

Pipe-laying activities would include pipe stringing, bending, welding, coating, lowering of pipeline sections, and backfilling. Special construction measures would be utilized where pipelines cross stream channels. Subsoil would be backfilled into the trench over the pipe. Site regrading would occur where necessary. Topsoil would be evenly spread over the disturbed area to a maximum depth of six inches, and reclamation of the pipeline route would occur as authorized by the BLM and the fee-surface owner.

Natural gas, if produced in sufficient quantities, would be transported by pipeline. The procedure utilized in transporting natural gas by pipeline is similar to that described for oil. As previously mentioned, based on what Phillips knows of the geology of the area, their targeted formations described in the APD, and the negligible quantities of gas encountered during previous drilling attempts by other companies in the area, Phillips does not expect to encounter gas during the drilling of this exploratory well. If non-producible quantities of gas are encountered with producible quantities of oil, the gas would be flared or vented as authorized by an approved venting or flaring permit issued by the BLM.

- Safety Systems - Because of the remoteness and sensitivity of the project area and operational timing constraints, safety shutdown systems would be included in the production facilities and well sites. Automatic shutdown systems would be used to assure that the wells cease operations when the flowline pressure is too high or low or if the well itself experiences an operations problem. The production facilities would also be operated with shutdown systems to control tank fillage. If for some reason tank space is limited, the wells would be shut in by high level controllers in the tanks. Automatic shutdown systems using a variety of technologies are available. The system used could include electronic equipment requiring electricity at the well pad, spring and pressure activated systems that do not require electricity, or a combination of the two. The well heads would be equipped with surface safety valves. Flowlines would be equipped with high- and low-pressure shutdowns. The tank battery facilities would be equipped with high- and low-pressure shutdowns on the pumps and high-level shutdowns on tankage. Secondary containment for all tankage would also be provided by a berm around the batteries and/or facilities site.

Impacts Due To Field Development

Water resources in the field area are the same as described previously for the proposed project area. Mill Draw has similar flow characteristics as described for Ruby and Gold creeks; however, the stream tends to be more intermittent along its length within the project area than Ruby or Gold creeks. The information on water rights and claims presented previously also applies to the field development area.

Impacts associated with the construction of drill pads, tank batteries, and access roads include the removal of vegetation, exposure of the soil surface, and compaction of the soil with resultant increases in overland flow and subsequent erosion and off-site sedimentation. If these changes occurred in close proximity to a stream, they could create the potential for increased streamflow, increased stream sedimentation, and subsequent degradation of water quality below standards. The magnitude and duration of these impacts depend on several factors, including slope aspect and slope gradient,

degree and area of soil disturbance, susceptibility of soil to erosion, and proximity to established drainage channels. The duration of time within which construction activities take place and the timely implementation of and success or failure of mitigation measures applied would also be factors. These potential impacts would be greatest soon after the commencement of construction activities but would decrease shortly after due to passive natural stabilization. Phillips proposes to implement best management practices, the site-specific erosion control, revegetation, and rehabilitation plan (Appendix D of the DEIS), Soil and Water Conservation Handbook (FS Handbook 2509.22), and Surface Operating Standards for Oil and Gas Exploration and Development (USDI-BLM and USDA-FS 1988) to minimize erosion and off-site sedimentation.

Minor stream channel disruption could occur where access road construction or reconstruction crosses streams such as at Gold and Ruby creeks and Mill Draw. Channel disruption could include alteration of channel configuration, gradient, or bed texture and subsequent changes in aggradation/degradation regime. All channel crossings would be designed and constructed to handle 50- to 100-year storm events and to minimize stream environment disruption.

Water would be used during road, drill pad, and tank battery construction as well as during well drilling and would be obtained and trucked from surface water and groundwater sources in the project area. It is possible that approximately 23 acre-feet (1.3 acre-feet per well) of water would be required for drilling alone. This demand would occur over the duration of the drilling period rather than at one point in time. Additional water would be required during construction of access roads, drill sites, and facilities sites; however, the quantity of water needed would be substantially less than the quantity needed for drilling. The quantity of water needed for construction purposes would be specified in a construction and use plan for the field development project. The quantity and rate of water withdrawal would be minimized and appropriate state permits would be obtained. The quantities of water used would be minimized so that impact to water resources would be minimal (i.e., no reduction in the watertable and/or in instream flows).

Impacts that would occur due to construction of access roads, drill sites and tank batteries would be minor. A slight increase in erosion and off-site sedimentation would occur; however, the quantities would be small in the short-term and non-existent in the long term. Exposed soil would be quickly stabilized and protected, and efficient runoff and drainage control structures (FS Handbook 2509.22 and Appendix D of the EIS) would be constructed at disturbed areas to minimize impacts to levels not considered significant. All drainage crossings would be designed and constructed to facilitate 50- to 100-year channel flows following standard engineering procedures. Most of the existing channel crossings would be upgraded to a more environmentally sound design. Erosion and sedimentation would occur below current levels through implementation of efficient runoff and erosion control structures.

Groundwater contamination could occur from well construction or operation due to the leakage of drilling fluids into groundwater or to the mixing of groundwater of differing quality from different aquifers. Groundwater, oil, and gas may occur under high pressure; upon being penetrated during well drilling, they could migrate laterally along geologic strata or vertically along the outside of the well casing to areas of lower pressure. Contamination could reach surface water in areas at or below seeps, springs,

or significant groundwater outflow. To prevent these potential impacts from occurring, the well would be fully cased with pressure-tested pipe and cemented as itemized in Phillips' APD. The annulus, or void space between the outside of the casing and the drill hole, would be filled and sealed with cement as stated in Phillips' APD.

Phillips proposes to use a closed mud system for well drilling. This system requires a substantially reduced storage capacity for drilling wastes and cuttings. The cuttings trench would be constructed in full cut on each drill site. This measure would provide adequate structural strength, thereby minimizing the potential of trench failure and subsequent spillage. Leakage of liquids would be possible; however, a properly installed synthetic liner would preclude leakage and subsequent contamination of groundwater or live streams in the development area. Trench overflow could potentially occur during or following drilling. Heavy rains or snowmelt could fill and overflow the trench. Over-design of the trench, or utilizing a maximum of 75 percent of its capacity for drilling wastes and the balance for direct precipitation and runoff, would preclude overflow.

Spillage of petrochemicals associated with construction or operation of the project could also impact both surface and groundwater if released in close proximity to streams. Facilities sites would be located far enough away from streams and drainage channels that a spill would not likely reach these hydrologic features. Except where roads cross streams, no facilities would be constructed within the 100-year floodplain of a stream. Further, a series of berms and/or interceptor trenches would be constructed around all facilities sites (i.e., drill sites, well sites, and tank batteries) to contain any petroleum product spill that might occur. The design and implementation of a chemical Spill Prevention, Control, and Countermeasures Plan (SPCC Plan) pursuant to Section 11.07 of the FS Handbook 2509.22 would greatly reduce impacts that could occur in the event of a spill.

Although pipelines would be placed within road rights-of-way where possible, thereby minimizing impacts, pipeline crossings of drainage channels could disrupt stream flows due to adverse changes in channel geometries and channel bed materials. Pipelines would be buried to a depth of at least four feet below the maximum scour depth associated with a 100-year flood event, and channel beds would be restored to predisturbance conditions in terms of geometry and bed material. Pipelines would be hydrostatically tested to establish competency. Water for use in hydrostatic testing would be obtained from state-permitted points of withdrawals (i.e., surface and groundwater). Once the testing was completed, the test water would be discharged into holding ponds to minimize the potential for soil scouring and either evaporated or used in the construction of facilities sites. The oil and gas industry has established that with specially treated pipe interiors, no adverse contamination of the test water would occur that could result in environmental degradation.

Oil and/or gas would need to be transported to existing underground pipelines or trucked to major transportation routes such as Montana Highway 72. Regardless of the mode of transport, the product would need to be transported across the Clarks Fork to reach the existing pipelines or Highway 72. Special construction design would need to be exercised for the pipeline crossing of the Clarks Fork. Similarly, precautions would need to be exercised in transporting oil across the Clarks Fork by truck. Phillips would design the product transportation plan and submit the plan for agency review and approval prior to project construction.

Although adverse impacts to water resources could occur due to drill site construction, operation, and reclamation, these impacts would not be considered significant relative to degradation of surface and groundwater, modification of surface water flow or groundwater levels, construction within a 100-year floodplain, downstream water control structures or water rights, or slope stability problems due to interception of shallow groundwater. Field development would not likely affect fishery resources in the project area, including the Clarks Fork due to the few perennial to intermittent streams in the field area and the large distance to the river.

Existing land and resource management activities within the project area primarily include grazing on non-Forest lands and road construction and use. These activities and uses have not substantially affected the water resources in the project area. Road construction and use has caused an increase in soil erosion since a portion of cut and fill slopes have not been revegetated. Further, since most of the roads in the project area are unimproved, drainage and runoff control are sub-optimal. This adds to the increase in soil erosion over natural base rates. Overall, these impacts are not cumulatively significant. Implementation of the field development project would likely decrease erosion and sedimentation from roads since drainage and runoff control would be improved; therefore implementation of the proposed project would not significantly add to these impacts. Further, the demand for approximately 7.6 million gallons of water over the drilling period (i.e., 6 to 18 years) would be small compared to the total amount of water available in the area. Therefore, meeting the demand for water used during construction and drilling would not cause substantial or significant cumulative impacts on water quantity in the project area.

With implementation of the mitigation measures summarized above; the specific mitigation items presented in Chapter 5 of the EIS; FS Handbook 2509.22; the Surface Operating Standards for Oil and Gas Exploration and Development; and the site-specific erosion control, revegetation, and rehabilitation plan presented in Appendix D of the DEIS, no unavoidable adverse impacts would occur to water resources.

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VEGETATION RESOURCES

VEGETATION RESOURCES TECHNICAL REPORT

Prepared For The

Ruby A Federal No. 1-9 Exploratory Oil/Gas Well Project

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AFFECTED ENVIRONMENT

General Vegetation

Vegetation of the project area is typical of the eastern flank of the Beartooth Mountains of the Middle Rocky Mountains Physiographic Province. The area is mountainous with steep, contrasting slopes that provide distinctly different and variable microclimates within a relatively small area. The highly variable slope position, aspect and gradient, and soil type typical of the area causes a great degree of variability in vegetation community or cover types and distribution of these types in the project area. The vegetation in the project area serves several functions including watershed stability, wildlife habitat and forage, livestock forage, visually pleasing landscapes, and recreation opportunities. Vegetation anchors and protects the soil to minimize erosion and detain moisture on the land, preventing excessive quantities of water runoff within a short period. The value of vegetation for wildlife forage and habitat is a major consideration in management of vegetation on wildlands as discussed in greater detail in the Wildlife Technical Report. Vegetative form, texture, color, and pattern are important factors in defining the quality of landscapes and the settings for outdoor recreation as discussed in greater detail in the Visual Resources and Recreation Technical Reports.

Field reconnaissance during several site visits, aerial observation, and aerial photos were used to identify six distinct vegetation cover types. These include five upland types (sagebrush scrub, limber pine woodland, mixed conifer, alpine bunchgrass and forblands, and agricultural land) and one wetland type (riparian cottonwood and willow). In addition, several existing documents were used to provide additional descriptive information including USDA-FS (1977 and undated), Pfister et al. (1977), and Mueggler and Stewart (1980). Exhibits C-1 and C-2 show the distribution of these types in the project area and in the vicinity of the drill sites, respectively. Table C-1 presents the frequency of occurrence of these types in both exhibits.

An area north of the Ruby A Federal No. 1-9 project area has been proposed by the Montana Nature Conservancy as a preserve because it supports a diverse and unique assemblage of vegetation and unusual landscape (Lesica 1988). This proposed Meeteetse Spires Preserve would encompass a large portion of the Grove Creek drainage, which exhibits unique plant associations and visually interesting palisades or Meeteetse Spires. Within the boundaries of this proposed preserve occur several plant species and one plant association of concern to the Nature Conservancy and the Montana Natural Heritage Program (MTNHP): Shoshonea pulvinata, Townsendia spathulata, Physocarpus monogynus, Hymenoxys torreyana, Castilleja chromosa, and Artemisia arbuscula plant species, and the Artemisia arbuscula/Agropyron spicatum plant association. As they may be affected by Phillip's proposed project, the section on Plant Species of Special Concern below contains more detailed information on the first four species.

Upland Vegetation

Sagebrush Scrub. The sagebrush scrub vegetation type primarily occupies the terraces and plains at lower elevations (4,000 to 6,000 feet) on the east side of the project area. This type also extends up the toeslopes of the mountains to approximately 7,000 feet

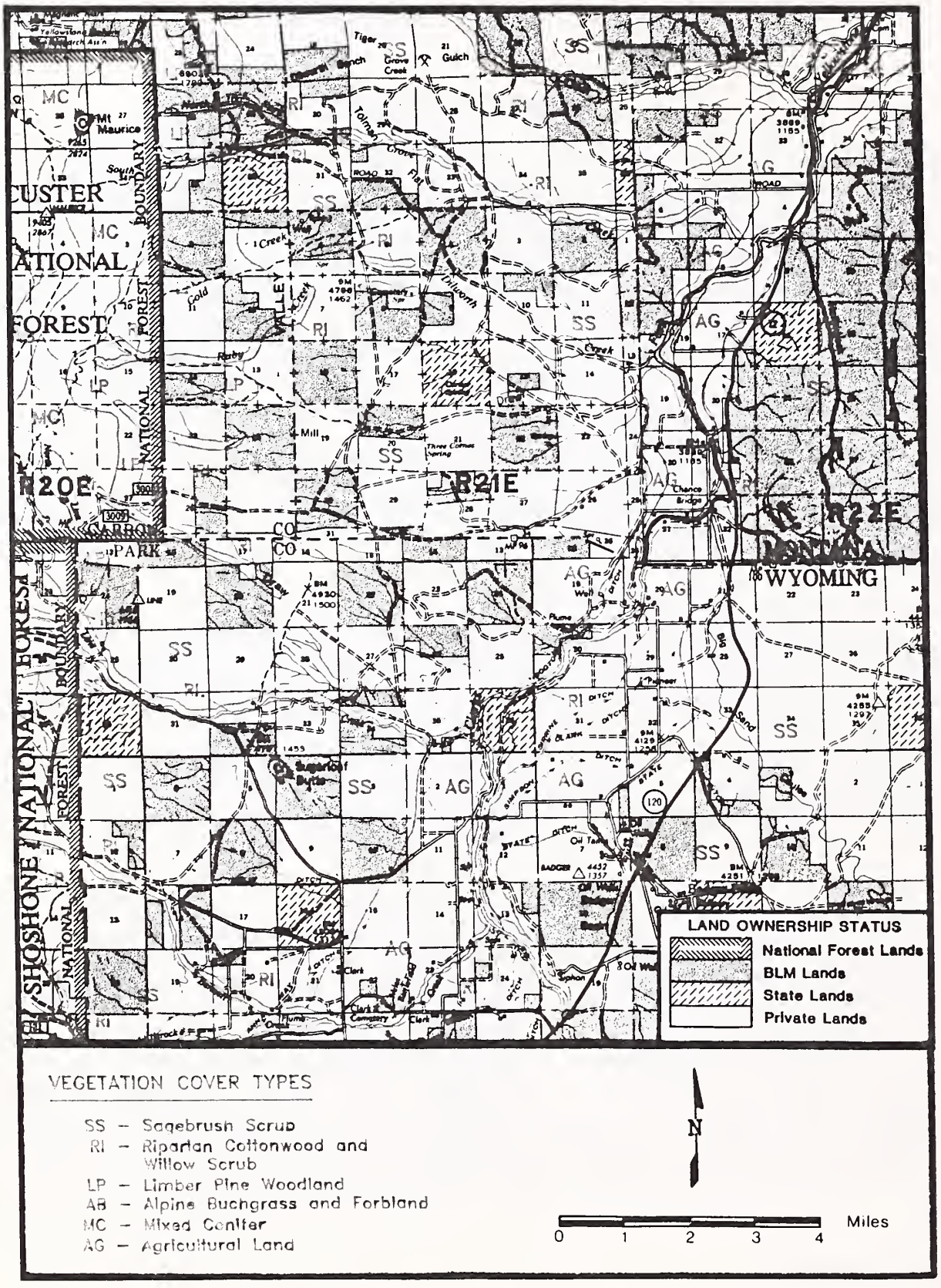

Exhibit C-1. Vegetation Cover Types in the Ruby A Federal No. 1-9 Project Area.

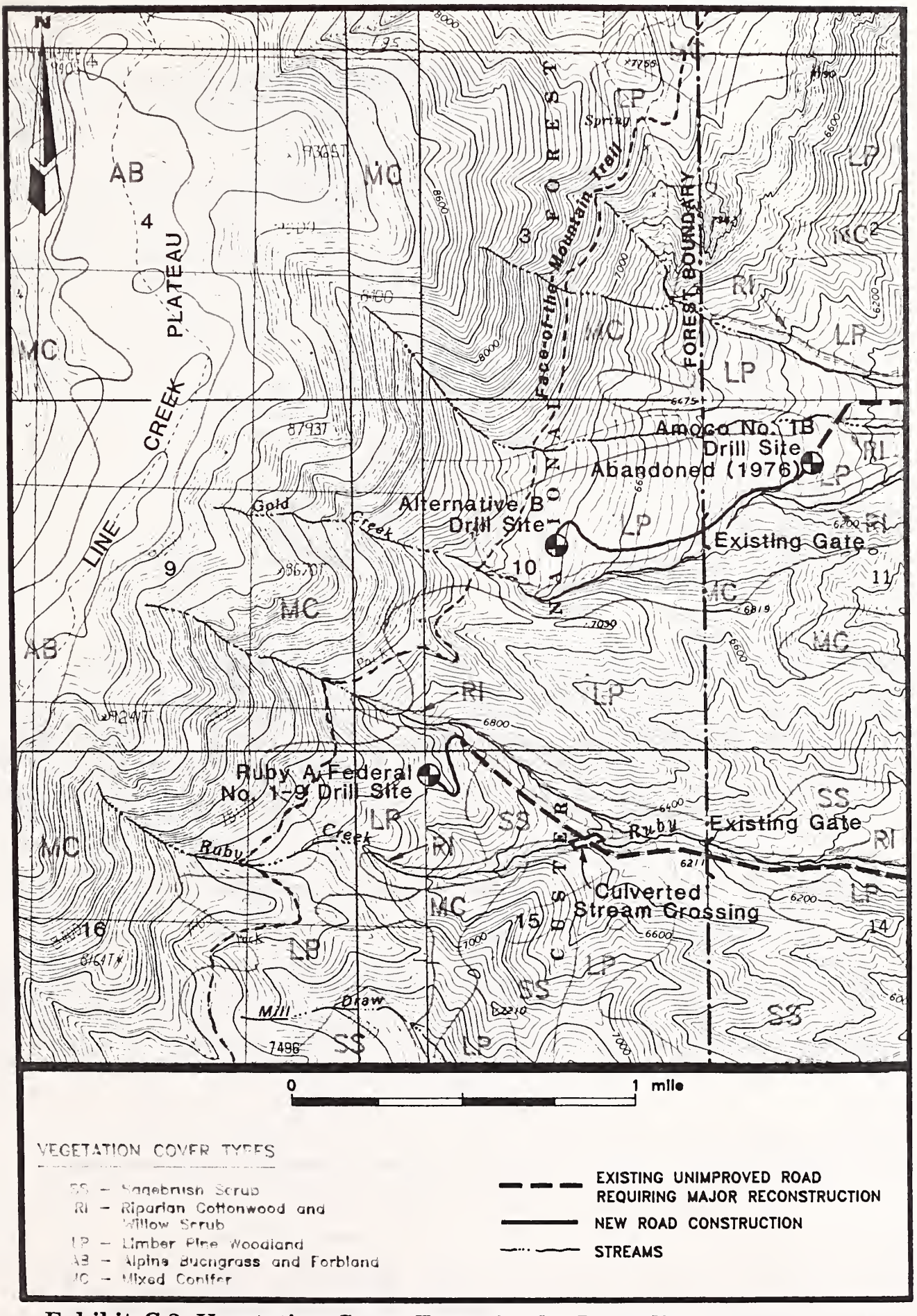

Exhibit C-2. Vegetation Cover Types in the Immediate Vicinity of the Ruby A Federal No. 1-9 Project.

Table C-1. Vegetation Cover Types and Frequency of Occurrence within the Project Area and the Immediate Vicinity of the Drill Sites.

Vegetation Cover Type	Percent Frequency of Occurrence	
	Project Area	Project Vicinity
Sagebrush Scrub	68	10
Limber Pine Woodland	6	31
Mixed Conifer	7	51
Alpine Bunchgrass and Forbland	1	6
Riparian Cottonwood and Willow Scrub	5	2
Agricultural Land	13	0
TOTAL	**100**	**100**

where it forms a mosaic with the limber pine woodland and mixed conifer types. A sparse to dense shrub layer with a relatively dense forb and grass understory characterizes this type. At lower elevations on the east side of the project area, black sagebrush, low sagebrush, and antelope bitterbrush dominate. Typical understory species of the lower elevations include blue grama, Indian ricegrass, needle-and-thread, western yarrow, Hood's phlox, pricklypear cactus, golden avens, hairy goldaster, cushion buckwheat, pale agoseris, silvery lupine, Indian paintbrush, rose pussytoes, and fringed sagebrush. Greasewood may also dominate the overstory of lower elevational areas with saline soils. At higher elevations on the mountain toeslopes, big sagebrush and rabbitbrush replace the dominant species while bluebunch wheatgrass, Idaho fescue, sheep fescue, western wheatgrass, prairie junegrass, milkweed, and fleabane daisy replace the understory species.

The sagebrush scrub vegetation type corresponds to several climax community types described by Mueggler and Stewart (1980) and includes needle-and-thread/blue grama, bluebunch wheatgrass/blue grama, big sagebrush/Idaho fescue, big sagebrush/bluebunch wheatgrass, and antelope bitterbrush/Idaho fescue habitat types. This vegetation type primarily occurs off the National Forest, corresponds to the grassland bench landtype (USDA-FS 1977), and is primarily managed for livestock and wildlife forage and habitat.

Limber Pine Woodland. The limber pine woodland vegetation type occurs topographically and elevationally above the sagebrush scrub type and is transitional between the lower elevational sagebrush scrub and the higher elevation mixed conifer types. This type has a relatively sparse overstory (< 30 percent) of limber pine, with minor amounts of Douglas-fir. Below the overstory is a typically sparse shrub layer of big sagebrush, common juniper, horizontal juniper, Wood's rose, gooseberry currant, and mallow ninebark. Forb and graminoid species are similar to those described for the higher elevation sagebrush scrub.

The limber pine woodland type corresponds to the limber pine/Idaho fescue, limber pine/bluebunch wheatgrass, and limber pine/common juniper habitat types as described by Pfister et al. (1977). This type also corresponds to the timber-grassland foothills and steep timber and grassland slopes landtypes (USDA-FS 1977) that the FS manages for wildlife habitat and forage, watershed stability, and recreation.

Mixed Conifer. The mixed conifer vegetation type occupies the mid- to upper elevation portion of the eastern flank of the Beartooth Mountains above the sagebrush scrub and limber pine woodland types. A dense (50 to 100 percent) conifer overstory on steep mountain slopes characterizes this vegetation type. At lower elevations (6,500 to 7,500 feet) limber pine and Douglas-fir dominate the overstory, corresponding to the limber pine habitat types and drier Douglas-fir habitats such as Douglas-fir/bluebunch wheatgrass and Idaho fescue habitat types as described by Pfister et al. (1977). At middle elevations (7,500 to 8,500 feet), Douglas-fir dominates this type, corresponding to the Douglas-fir/mallow ninebark, common juniper, and elk sedge habitat types. At higher elevations (8,500 to 9,400 feet) Douglas-fir, subalpine fir, lodgepole pine, and Engelmann spruce dominate. This composition correspond to Pfister's subalpine fir/elk sedge, gooseberry currant, and grouse whortleberry habitat types. At the highest elevations transitional to the alpine ecosystem on the Line Creek Plateau is the location where whitebark pine dominates. The trees are characteristically stunted and wind sculptured. Pfister et al. (1977) describes the vegetation at this elevation as the subalpine fir-whitebark pine habitat type.

At lower to mid- elevations within the mixed conifer type is a conspicuous understory shrub layer of snowberry, ninebark, and common juniper that yields to grouse whortleberry at higher elevations. At lower elevations, forb and graminoid species are similar to those for the limber pine woodland type. At higher elevations, sheep fescue, spike trisetum and Ross sedge dominate the understory. This vegetation type corresponds to the mountainous slopes and smooth mountain uplift landtypes (USDA-FS 1977) managed by the FS for wildlife habitat and forage, watershed stability, and recreation.

Alpine Bunchgrass and Forblands. The alpine bunchgrass and forbland vegetation type as defined by the FS (USDA-FS 1980) occurs above the mixed conifer type on the Line Creek Plateau at 9,400 feet. A low (< 1 foot) growth habit of alpine bunchgrasses and forbs, and in harsher areas cushion plants, composes this type. Forb and graminoid species include dryas, moss silene, yellow avens, varileaf cinquefoil, curly sedge, spike trisetum, sheep fescue, alpine timothy, and alpine bluegrass. This vegetation type corresponds to the alpine turf landtype (USDA-FS 1977) and is primarily managed for wildlife forage and habitat, watershed, and recreation.

Agricultural Land. The agricultural land occurs primarily on the alluvial bottomlands and toe slopes associated with the Clarks Fork. Crops such as alfalfa, pasture hay, row crops, and small grains are produced on these lands.

Wetlands

Wetlands are defined by the Clean Water Act as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Federal Register 1986). Wetlands merit special concern

because of their relative rarity in the region, their unique value as wildlife habitat and forage, their functional role as components of hydrologic systems, and their protection under the Clean Water Act. The Department of Army Corps of Engineers (COE) has administrative authority over wetlands. Through Section 404 guidelines and permitting process, the COE regulates all activities that affect the waters of the United States and their associated (adjacent and isolated) wetlands. To qualify for COE administrative consideration, a wetland must meet three criteria (Environmental Laboratory 1987): 1) the presence of hydrophytic plants, 2) the presence of hydric soils, and 3) the presence of surface or subsurface water to support 1 and 2 (above). Wetlands have gained considerable recognition for their functional value in both biological and physical systems. These functions include groundwater discharge and recharge, flood storage and desynchronization, shoreline anchoring and dissipation of erosive forces, sediment trapping, nutrient retention and removal, food chain support, wildlife and fish habitat, and active and passive recreation and heritage value (Adamus and Stockwell 1983).

Wetlands within the project area primarily include riparian zones along the perennial and intermittent drainages such as Ruby Creek and Gold Creek. Exhibits C-1 and C-2 show the distribution of the riparian cottonwood and willow scrub wetland within the project area.

Riparian Cottonwood and Willow Scrub. The riparian cottonwood and willow scrub vegetation type occurs in narrow bands along perennial and intermittent stream drainages at mid to low elevations (7,500 to 4,000 feet) within the project area. This type is generally discontinuous along the drainages due to the highly permeable alluvium and glacial outwash that contain the stream channels and the intermittent flow characteristic of the streams. A dense overstory is dominated by black cottonwood, narrowleaf cottonwood, aspen, thinleaf alder, and water birch. A sparse to dense shrub layer is typical and consists of red osier dogwood, currant, Wood's rose, black hawthorn, sandbar willow, and Bebb willow. A dense forb and graminoid ground cover exists and includes tufted hairgrass, redtop bentgrass, horsetail, wire rush, and various sedges. This vegetation type is primarily managed for wildlife forage and habitat, watershed, and recreation, and livestock grazing off-Forest.

Noxious Weeds

Undesirable plants such as noxious weeds are also part of the vegetative environment of the project area. The Custer National Forest has prepared a noxious weed treatment program and environmental impact statement (USDA-FS 1986a). The Custer National Forest has identified nine noxious weed species that concern the FS: leafy spurge, spotted knapweed, Canada thistle, hemp, Russian knapweed, dalmatian toadflax, wormwood, sowthistle, and St. Johnswort. The Custer National Forest inventoried the Beartooth Ranger District for noxious weeds in 1985 and found approximately 3 acres of leafy spurge, 114 acres of spotted knapweed, and 12 acres of dalmatian toadflax. The occurrence of noxious weeds relates directly to soil disturbance associated with development and resource extraction.

Plant Species of Special Concern

Plant species of concern include species listed as threatened or endangered under the federal Endangered Species Act, species proposed for federal listing, candidate species under consideration for federal listing, and species of concern to the Montana Natural Heritage Program (MTNHP). Due to the late season of work initiation for this project, no plant surveys were completed for the project area; therefore, discussion on these plants is based on existing information from the MTNHP files. According to the MTNHP (Shepperd 1988) there are 16 plant species of concern in the vicinity of the proposed project. None of these are federally listed, and only three have candidate status for federal listing. Table C-2 lists these species, their status, habitat, and nearest location to the project area. Most of these species (9) exploit habitat in the alpine bunchgrass and forblands vegetation type above and west of the immediate project area. Species within this community type would not be impacted by Phillips' proposed project. The other species of concern (7) occur north and northeast in the sagebrush scrub or limber pine woodland cover types or southwest in the mixed conifer cover type. None are known to occur in the immediate vicinity of the project area. Appendix C contains the MTNHP element occurrence data files for these 16 species, while Appendix A contains data files for species of concern within the proposed Meeteetse Spires Preserve north of the proposed project area.

Species of Concern - 15-mile Radius of Project Area

Bird's-Foot Sagebrush. Commonly known as bird's-foot sagebrush, Artemisia pedatifida, is a sub-shrub up to 1.5 dm high with silvery-canescent principal leaves that are covered with silky, long, appressed hairs and toothed in three's (Hitchcock and Cronquist 1973). This plant favors dry mesas, ridges, hills or high plains of Wyoming to Carbon County, Montana.

According to the Montana Natural Heritage Program (MTNHP; Shepperd 1988) file report, bird's-foot sagebrush has a global status of G3G4. The plant has no federal status. The state status for Montana is S2. The MTNHP defines the global G3 rank as plants as threatened throughout its range. This may be because it is either very rare and local throughout its range, it is found locally (even abundant in some locations) in a restricted range, or there are other factors that make it vulnerable to extinction throughout its range. G3 plants generally range between 21 to 100 occurrences throughout the world. Global status of G4 places the plant as globally secure though rare in parts of its range. State S2 rank means that the plant is imperiled because of rarity (6 to 20 occurrences in the state) or because of other factors demonstrably making it very vulnerable to extirpation from the state.

One element occurrence (EO) was sighted within a 15-mile radius of Line Creek Plateau. This sighting occurred in 1893 on Sec 26 T7S R20E on privately owned land. The physical province of this area is the Missouri Breaks. The elevation was 5,670 feet at the centrum of the EO. No habitat description was provided in the MTNHP files.

Porsild's Draba. No description of Porsild's draba (Draba porsildii) was found. This plant has an unknown global rank, no federal rank, and a state rank of S1 or critically endangered in Montana because of extreme rarity--5 or fewer occurrences or very few remaining individuals--or because some factor of its biology makes it especially vulnerable to extermination from the state.

Table C-2. Plant Species of Special Concern within a 15-mile Radius of the Ruby A Federal No. 1-9 Project.

Common Name	Scientific Name	Status Fed[a]	Status State[b]	Habitat	Nearest Location
Bird's foot sagebrush	Artemisia pedatifida	none	G3S2	Missouri breaks, sagebrush and limber pine at 5,670 feet.	10 mi. N
Porsild's draba	Draba porsildii	none	GUS1	Alpine bunchgrass and forblands vegetation cover type from 9,000 to over 11,000 feet.	10 mi. W
Pretty daisy	Erigeron formosissimus	none	GUSU	Mountain brush, sagebrush, limber pine, meadows, and aspen at 5,760 feet.	14 mi. NNW
Torrey bitterweed	Hymenoxys torreyana	none	GUS1	Limber pine woodland at 7,100 feet.	5 mi. NNE
Kobresia	Kobresia macrocarpa	none	G5S1	Mossy bog in alpine bunchgrass and forbland vegetation cover type at 9,800 feet on Line Creek Plateau.	7 mi. W
Island koenigia	Koenigia islandica	none	G4S2	Alpine bunchgrass and forbland vegetation cover type at 9,800 feet on Line Creek Plateau.	7 mi. WSW
Alpine poppy	Papaver kluanensis	none	GUS1	Alpine bunchgrass and forbland vegetation cover type at 11,000 feet.	15 mi. W
Oeder's lousewort	Pedicularis oederi	none	GUS2	Bog marginal to a lake within Alpine bunchgrass and forbland on the Line Creek Plateau at 9,000 feet.	6 mi. WSW
Ice grass	Phippsia algida	C3	G5S1	Alpine bunchgrass and forbland vegetation cover type at 9,800 feet on the Line Creek Plateau.	6 mi. WSW
Mountain ninebark	Physocarpus monogynus	none	G2SU	Limber pine woodland at 6,500 feet.	4 mi. NNE

Table C-2. Continued.

Common Name	Scientific Name	Status Fed[a]	Status State[b]	Habitat	Nearest Location
Barratt's willow	Salix barrattiana	none	G3S1	Alpine bunchgrass and forbland vegatation cover type at 10,000 feet on the Line Creek Plateau.	7 mi. SSW
Golden saxifrage	Saxifraga chrysantha	none	GUS1	Alpine bunchgrass and forbland at 11,360 feet.	15 mi. W
Alpine groundsel	Senecio amplectans	none	GUS1	On granitic talus within limber pine and mixed conifer at 7,700 feet.	14 mi. SW
Twice-hairy butterweed	Senecio fuscatus	none	G4S2	Alpine bunchgrass and forbland at 10,200 feet.	9 mi. SW
Shoshonea	Shoshonea pulvinata	C2	G3S1	Limber pine woodland on limestone soils at 7,100 feet.	3 mi. NNE
Sword townsendia	Townsendia spathulata	C3	G3S2	Limber pine woodland on limestone soils at 6,200 feet.	3 mi. NNE

a - Federal Status:
C2 - threat and/or distribution data are insufficient to support federal listing.
C3 - threat and/or distribution data are sufficient to indicate that federal listing is not warranted.

b - State Status:
Global Rank
G1 - Critically imperiled globally because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction. (Critically endangered throughout range).
G2 - Imperiled globally because of rarity (6 to 20 occurrences) or because of other factors demonstrably making it very vulnerable to extinction throughout its range. (Endangered throughout range).
G3 - Either very rare and local throughout its range or found locally (even abundant at some of its locations) in a restricted range, or because of other factors making it vulnerable to extinction throughout its range; in the range of 21 to 100 occurrences. (Threatened throughout range).
G4 - Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
GU - Possibly in peril range-wide, but status uncertain; more information needed.

State Rank
S1 - Critically imperiled in Montana because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extirpation from the state. (Critically endangered in state).
S2 - Imperiled in Montana because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extirpation from the state. (Endangered in state).
SU - Possibly in peril in Montana, but status uncertain; more information needed.

Source: MTNHP 1988

The two EO's from the MTNHP files were from the area of Silver Run Peak: one from N1/2 Sec 20 T8S R18E at an elevation of 11,800 feet and one from along the Beartooth Highway in the center of Sec 17 R9S R19E at an elevation of approximately 9,000 feet. Both sites were last observed in 1981, and both occur in the Middle Rockies physiographic region of the state. The habitat description for the first occurrence is gravelly soil around rocks on a ridge. Parent material is granitic, and the species occurs in association with golden avens and dwarf clover. The second EO was sighted on a steep northeast facing slope with granitic parent material. Associated species listed in the file are Yellowstone draba and moss silene. Madrono (1984) states the significance of these sites as an extension of the known range approximately 800 km south from Alta.

Pretty Daisy. Pretty daisy (Erigeron formosissimus) is a perennial herb arising from a woody base that is subrhizomatous. Welsh et al. (1987) describes the herbage as variously hirsute to glabrous to glandular, with the stems more or less glandular above; the basal leaves are oblanceolate to spatulate and the leaves on the stems are reduced upwards, lanceolate to oblong to ovate. Flower heads are white, blue, or pink. This plant is known from mountain brush and meadows in aspen.

Pretty daisy's global status was unknown in the MTNHP file, and the plant has no federal status. On the Montana state status the species ranks SU, a plant whose status is possibly in peril but uncertain and more information is needed prior to a definite decision.

Last observed in 1919, the MTNHP has one record EO on privately owned land in Sec 26 of T7S R20E. The physical province is the Missouri Breaks near Red Lodge, Montana. The elevation of the sighting was 5,760 feet.

Torrey Bitterweed. Torrey bitterweed (Hymenoxys torreyana) is a perennial, caespitose herb arising from a stout caudex (Welsh et al. 1987). The branches of this caudex are densely villous with brown to straw colored or ashy leaf bases from 3 to 10 cm. All leaves are basal, oblanceolate, and gland-dotted. Flower heads are solitary disks with yellow ray flowers and hemispheric involucres. This plant occurs among sagebrush, mountain brush, and pinyon-juniper communities.

Although this plant has no federal status, it has a state rank of S1 (critically endangered in state). The MTNHP files list this plant's global status as unknown.

One MTNHP sighting of this plant consists of a small population of approximately 101 to 1,000 plants located on privately owned undisturbed habitat within the north fork of Grove Creek, W1/2 W1/2 Sec 23 T8S R20E. The population exploits approximately 15 acres of a limestone lithosol at 7,100 feet within the Wyoming Big Horn Basin physiographic region. The vegetation at the site is a Douglas-fir/limber pine fellfield with shoshonea, shrubby cinquefoil, and alpine forget-me-not. The last observation of this population was in 1986.

Kobresia. Kobresia (Kobresia macrocarpa), according to Harrington's Manual of the Plants of Colorado (1954) where it is listed under the name Kobresia bellardi macrocarpa, is a densely caespitose, perennial, herbaceous plant that occurs on rather moist open ground. The monecious flowers usually occur in twos with the inner one pistillate and the outer one staminate.

This plant has a global status of G5: globally secure though it may be rare in parts of its range, especially at the periphery. The species has no federal status and a state status of S1 (critically endangered).

The MTNHP had one EO, last observed in 1980, on file. The site, in N1/2 NW1/4 Sec 33 of T9S R19E, is near Beartooth Pass and along a small west side branch of the Wyoming Creek headwaters. This population covers approximately 50 acres within the Middle Rockies physiographic region. The elevation is 9,800 feet. The habitat description is mossy bog with low-growing willow and stonecrop and in a diversity of alpine habitats.

Island Koenigia. Commonly named island koenigia, one EO of Koenigia islandica was found on the Beartooth Plateau immediately north of the Wyoming-Montana state line. This area is in the Middle Rockies physiographic province.

Island koenigia has a global status of G4 (globally secure, rare in parts of range) and a state rank of S2 (endangered in state). The plant has no federal status.

The habitat of the single MTNHP sighting is on wet gravel bars with ice grass and cerastium at an elevation of 9,800 feet in NW1/4 Sec 23 T9S R19E. The last observation of this EO was in 1980. Madrono (1982) underlines the significance of this sighting as the first report for Montana and says that all occurrences were less than 12 km from Park county, Wyoming.

Alpine Poppy. Alpine poppy (Papaver kluanensis) is a plant that grows in tufts from a branching woody base to a height of 4 to 11 cm. Leaves from this base are pinnately lobed and covered with coarse stiff hairs. Stems are covered with blackish hairs up to the sepals. Petals are yellow.

This species has no defined global rank and no federal status but has a state ranking of S1 (critically endangered).

The MTNHP provided two EOs for the project area. One occurrence was in Sundance Pass, NE1/4 Sec 25 in T8S R17E, at an elevation of 11,000 feet; the other occurred 1 km east of Silver Run Peak in N1/2 Sec 20 T8S R17E at an elevation of 11,700 feet. These populations were last observed in 1981. These occurrences are noteworthy because they are the first report for this species in Montana and extend the range 200 km north northwest from the Big Horn Mountains of Wyoming (Madrono 1983). No information was provided for this EOs' habitat description.

Oeder's Lousewort. Oeder's lousewort, (Pedicularis oederi) described in Hitchcock and Cronquist (1973), is an upright perennial herb with pinnate leaves that are toothed but not strongly incised. Most of the leaves are basal, with the few cauline leaves more or less reduced. The flower corolla is yellow or yellowish-white and sometimes tinged with pink or purple. The plant is a circumboreal that occurs in the Rocky Mountains to northwest Wyoming and southern Montana.

The MTNHP gives the following information on this plant: Oeder's lousewort has no federal rank, a state rank of S2 (endangered), and an unknown global rank.

One EO was on file and was last observed in 1966 southwest of Red Lodge at 9,920 feet. The plant occurs in the Middle Rockies physiographic province at the legal description Sec 20 T9S R19E. The habitat description was wet grassy banks along a small lake in association with alpine bog kalmia, willow, and violet.

Ice Grass. Ice grass (Phippsia algida) is a perennial grass that is densely tufted with long, flat, blades that have keeled tips. the inflorescence occurs in a long and narrow panicle, the appressed branches of which have few flowers. The glumes are unequal and the second glume is 1/2 the length of the lemma, truncate, and erose at the tip. This plant exploits mountain summits and arctic regions (Harrington 1954).

This plant has a global rank of G5 (demonstrably secure), federal status of 3C, and a state rank of S1 (critically endangered). Federal 3C status means the plant has proven to be more abundant or widespread than previously believed and therefore not subject to any identifiable threat.

Three EO's were on the MTNHP files. The first two occurrences were last observed in 1980; the third occurrence was last observed in 1981. The first site is at the Wyoming Creek headwaters, N1/2 NW1/4 Sec 33 T9S R19E, along the Montana-Wyoming border at the south end of Line Creek Plateau. Elevation at the centrum of the 50-acre population is 9,800 feet. There is a jeep trail and gravel pit nearby but not affecting the site. The habitat was wet gravel bars with island koenigia and cerastium and a diversity of alpine habitats. The second sighting was in the Beartooth Mountains, Line Creek Plateau, at 9,840 feet in Sec 23 T9S R19E. The habitat was again wet gravel bars. The third sighting occurred at 10,660 feet on the Silver Run Plateau of the Beartooth Mountains, Sec 23 T8S R18E. The habitat was described as wet gravel on a gentle slope. Madrono (1984) reports the significance of these sightings as the first report of ice grass in Montana.

Mountain Ninebark. Mountain ninebark (Physocarpus monogynus) is a shrub with a height ranging from 4 to 20 dm. The twigs may be glabrous to densely stellate while on older branches the bark is shreddy. The leaves are ovate to orbicular, commonly three-lobed, and doubly crenate. Sometimes the leaves are stellate-hairy, especially on the lower side. The flowers are corymbose and white. This plant occurs in canyon bottoms and moist slopes within mountain brush, aspen, and Douglas-fir according to Welsh et al. (1987).

The MTNHP records give this plant a global G2 status, no federal status, and a state status of SU (status uncertain). Plants with G2 status are endangered throughout their world range due to rarity--6 to 20 occurrences--or to other factors that make its extinction possible.

The MTNHP provided one EO within the 15-mile radius of the project area. The last observation of this population was in 1986. The population, which covers 500 acres, occurs at an elevation of 6,500 feet in the north fork of Grove Creek (E1/2 Sec 26, and in Secs 23 and 25 T8S R20E) on privately owned land. The physiographic province is the Wyoming Big Horn Basin. An estimated 1,000 to 10,000 plants occur in three subpopulations with no evidence of disturbance. The habitat is shallow limestone soil with Douglas-fir/limber pine fellfield and forest, along with mallow ninebark, and shrubby cinquefoil. According to the file, the full extent of the EO is unknown and borders the Middle Rockies physiographic province.

Barratt's Willow. Barratt's willow (Salix barrattiana) is a shrub seldom higher than 2 with sessile catkins that are not leafy-bracteate. These aments develop before or along with the appearance of the leaves. The ovaries and capsules are more or less densely short-hairy. Leaves of this willow are covered with long, soft, appressed hairs but not discolored with pubescence. The twigs are not glaucous.

This willow ranks G3 globally (threatened throughout range) and S1 (critically endangered) for the state rank. It has no federal status.

The one EO in the vicinity of the Line Creek Plateau occurs on the south end of Line Creek near the Wyoming Creek headwaters. A jeep trail and gravel pit occur nearby but do no affect the EO. Elevation at the 50-acre site is 10,000 feet in N1/2 NW1/4 Sec 33 T9S R19E. The physiographic province is the Middle Rockies. The habitat was described as alpine meadow occurring with glaucous willow, wolf willow, and plainleaf willow and in a diversity of alpine habitats. The EO described the shrub as 5 dm high.

Golden Saxifrage. Golden saxifrage (Saxifraga chrysantha) is an herbaceous plant whose slender rhizomes allow it to be sometimes mat forming (Welsh et al. 1987). The stems are glandular, and the leaves overlap at the stem base but scatter upwards. The leaves are narrowly spatulate to oblong and may be sparsely glandular. The leaf margins are not divided. The yellow flowers are solitary on the stems. This plant occurs on fellfields, rock stripes, and alpine tundras.

The global status of this species is unknown, and the plant has no federal status. The state status, however, is S1 or critically endangered.

The single occurrence reported by the MTNHP is in the Absaroka-Beartooth Wilderness Area 1 km southeast of Silver Run Peak. This sighting occurs in the Middle Rockies physiographic province at an elevation of 11,360 feet in Sec 20 of T8S R18E. The habitat is described as tundra on a south facing slope. The last observation of this plant occurred in 1981. Madrono (1984) under noteworthy collections states that this is the first report of the species for Montana.

Alpine Groundsel. Welsh et al. (1987) describes clasping or alpine groundsel (Senecio amplectans var. holmii) as a short-rhizomatous perennial herb with stems mainly 8 to 30 cm tall. The main leaves are middle or lower cauline while the lower leaves are petiolate and clasp the stem. Leaves are lobed or dentate. The flower heads are corymbose with yellow ray flowers and a white pappus. The species often occurs in talus or on ridge margins within spruce-fir and alpine tundra communities.

This species has a state rank of S1 (critically endangered) and no federal status. The global rank is unknown.

The one EO on the MTNHP file was last observed in 1955. This population occurred at an elevation of 7,680 feet in Sec 19 T9S R19E. The physiographic region is the Middle Rockies, and the site faces west on relatively stable granitic-schistoid talus at the rim of the Beartooth Mountains, just west of Quad Creek.

Twice-Hairy Butterweed. Senecio fuscatus, the common name of which is twice-hairy butterweed, is a perennial herb with pubescent basal leaves with the coarse hairs

overlain by moderately deciduous, cobwebby hairs. The leaves on the stem are reduced upwards in size. Margins are generally entire. The flower heads are erect, and the ray flowers are orange. This is an arctic-alpine species (Hitchcock and Cronquist 1973).

Although this plant has no federal status, it has a state rank of S2 (endangered). Its global status is G4 (globally secure, rare in parts of range).

The one EO provided by the MTNHP occurs by the Beartooth Highway at the Wyoming state line in N1/2 Sec 32 T9S R19E. Elevation at this location in the Middle Rockies physiographic province is 10,200 feet. The habitat was described as gentle granitic slopes of open alpine meadow, smartweed and clover. Element data describes the particular ray flowers at this sighting as yellow-orange. The last observation was in 1978.

Shoshonea. Shoshonea (Shoshonea pulvinata) is a low growing, cushion shaped and pleasantly aromatic perennial herb arising from a woody taproot as described by Evert and Constance (1982). Its leaves are petiolate, unequally pinnate or odd pinnate, and leathery; the blade outline is ovate to oblong while the leaflets are oblanceolate, linear, or cuspidate. Lower leaflets are often lobed; the inflorescence is a subcompact compound umbel of yellow flowers that are sessile if perfect and pedicellate when staminate; and the fruit is a pericarp with a lignified layer of tissue. The species is restricted to calcareous outcroppings and soils derived from limestone within limber pine and Douglas-fir woodlands at elevations ranging from 7,100 feet to 7,800 feet.

The MTNHP respectively lists the plant's global, federal, and state rank as G3 (threatened), S1 (critically endangered), and C2, respectively. Federal status of C2 classifies the plant as one for which current information indicates that proposal for listing as threatened or endangered is possibly appropriate but biological information must be gathered to support an immediate ruling.

Evert and Constance (1982) state that this species is known only from Park County, Wyoming; therefore, the three EO's on the MTNHP files represent a northward extension of its range. Only one of these EO populations, however, occurs within the 15-mile radius, approximately 5 miles north northeast of the project area; the other two populations occur in the Pryor Mountains located approximately 50 miles east of the proposed project. The closest population occurs in the physiographic province of Middle Rockies in three large subpopulations and covers approximately 50 acres of privately owned land at an elevation of 7,140 feet in N1/2 NW1/4 and E1/2 SW1/4 of Sec 26 as well as in W1/2 of Sec 23 T8S R20E. The site in an almost completely undisturbed location at the Grove Creek pinnacles on gravelly limestone soils on windblown ridge tops vegetated with an overstory of scattered limber pine and Douglas-fir and among such understory species as Howard's alpine forget-me-not, Henderson spring parsley, and kelseya. Very few weedy species occur at the site which was last observed in 1986. There were an estimated 6,000 to 8,000 plants in the three subpopulations, with approximately 3,000 to 4,000 plants in the south site.

Sword Townsendia. No species description was found for Townsendia spathulata or sword townsendia. This plant has a global rank of G3 (threatened), a federal status of 3C (not subject to identifiable threat), and a state rank of S2 (endangered).

Last observed in 1986, the single EO in the given radius occurs in the north fork of Grove Creek on limestone lithosol and talus in a Douglas-fir/limber pine fellfield with pussytoes, woolly groundsel, spring parsley, and Howard's alpine forget-me-not. The physiographic province is the Missouri Breaks. The elevation is 6,200 feet at the centrum of the 50-acre site in Sec 35, in N1/2 N1/2 Sec 26, and in SW1/4 Sec 23, T8S R20E. Approximately 51 to 100 plants occurred in four small, sparse subpopulations. The site had no evidence of disturbance.

Grazing and Timber Management

There are no intensively managed timber stands on lands administered by the FS (USDA-FS 1986b) or the BLM (USDI-BLM 1983) in the immediate vicinity of the project area; therefore, no timber harvests are planned in the limber pine and mixed conifer types in the project area. Only one grazing allotment, the Grove Creek allotment, occurs on BLM-administered land and adjacent private and State land to the east of the Forest boundary (USDI-BLM 1983). This allotment contains 9,173 acres of BLM-administered land and 14,334 acres of private land. This cattle allotment is divided into four discrete pastures and managed on a rest rotation system. The allotment is used year-round. The BLM portion of the allotment provides 1,295 animal unit months (AUMs) for an average of approximately seven acres per AUM (USDI-BLM 1983). Only 581 AUMs are currently utilized. Approximately 59 percent of the allotment is in excellent to good condition and the overall trend is static. There are no allotments or livestock grazing on lands administered by the FS in the immediate vicinity of the project area (USDA-FS 1986b).

Site-Specific Conditions

Alternative A - Proposed Action

Access Route

Access would utilize existing roads to within 0.3 miles of the proposed drill site. Initially from State Highway 72, the access route traverses agricultural land for the first two miles. Upon leaving the agricultural land, the access route traverses approximately 11 miles of sagebrush scrub vegetation on glacial outwash plains, fans, and terraces. The last mile of access route traverses limber pine woodland. The access route parallels the riparian zone associated with Ruby Creek for approximately three miles and crosses the creek near the terminus of the existing unimproved road. None of the species of special concern listed in Table C-2 were identified along the access route; however, most plants were desiccated, precluding positive identification. The access route traverses the Grove Creek allotment that was described previously.

In addition to the proposed access route, three access route variations to the proposed drill site have been identified by the BLM and FS for consideration. Access route Variation A2 traverses sagebrush scrub from its deviation from the Grove Creek Road to its confluence with Variation A1 near Mill Draw. Vegetation along this variation is the same as described for Variation A1. Access route Variation A3 initially crosses approximately 1.5 miles of agricultural land on the alluvial bottomlands along the Clarks Fork. Minimal riparian vegetation lines the bank of the river at this point.

Upon reaching the Robertson Draw Road, this variation crosses sagebrush scrub as described previously for Variation A2. Variation A4 traverses approximately five miles of agricultural land from Highway 120 to the beginning of the unimproved two-track road. In addition, narrow bands of riparian vegetation associated with Bennett Creek would be crossed. The unimproved two-track road crosses sagebrush scrub and a narrow zone of riparian vegetation associated with Line Creek to its terminus with the Robertson Draw Road. From this point, Variation A4 is the same as Variations A1, A2, and A3 to the drill site.

Drill Site

The proposed drill site is located on a sagebrush scrub opening on a structural bench within the limber pine woodland vegetation cover type. Half of the drill site area is covered by a grass dominated layer, while the other half is dominated by big sagebrush. Two 100-foot transects were established across the drill site to quantitatively determine predisturbance conditions. The transects indicated that approximately 32 percent of the area was covered by grass, 32 percent by shrubs or sub-shrubs, 11 percent by forbs, 7 percent by moss and/or cryptogamic crust, 3 percent bare soil, 3 percent rock and 12 percent litter. Predominant grass species included sheep fescue, Idaho fescue, bluegrass, and prairie junegrass. Shrub species included big sagebrush, rabbitbrush, and common juniper. Forb species included lupine, yarrow, Hood's phlox, fleabane daisy, and cymopterus. Overstory canopy cover ranges from 30 to 60 percent in the surrounding stands of limber pine. None of the species of special concern listed in Table C-2 were identified at the drill site; however, most plants were desiccated, precluding positive identification.

Alternative B - Gold Creek Site

Access Route

Vegetation resources along this access route are very similar to that described for Alternative A. Access would utilize existing roads to within 0.8 miles of the proposed drill site. Initially from State Highway 72, the access route traverses agricultural land. Upon leaving the agricultural land for the first 2.0 miles, the access route traverses approximately 7.0 miles of sagebrush scrub vegetation on glacial outwash plains, fans, and terraces. The last 2.0 miles of access route traverses limber pine woodland. The access route crosses Gold Creek and parallels the riparian zone associated with Gold Creek for approximately 0.5 miles. None of the species of special concern listed in Table C-2 were identified at the drill site; however, the desiccated state of the plants precluded positive identification. The access route traverses the Grove Creek allotment that was described previously.

Drill Site

This drill site is located on deep ground moraine covered with limber pine woodland vegetation cover type. The general drill site area is covered by an overstory canopy cover of approximately 30 percent consisting of limber pine and Douglas-fir trees. Two 100-foot transects were established across the drill site to quantitatively determine predisturbance conditions. The transects indicated that approximately 29 percent of the area was covered by grass, 41 percent by shrubs or sub-shrubs, 3 percent by forbs, 1 percent by moss and/or cryptogamic crust, 1 percent bare soil, 14 percent rock and 10

percent litter. Although not sampled, overstory canopy cover is approximately 30 to 70 percent. Predominant graminoid species included sheep fescue, Idaho fescue, Canada wildrye, elk sedge, and prairie junegrass. Shrub species included big sagebrush, rabbitbrush, and common juniper. Forb species included lupine, yarrow, Hood's phlox, fleabane daisy, pussytoes, and cymopterus. None of the species of special concern listed in Table C-2 were identified at the drill site; however, the desiccated state of the plants precluded positive identification.

NATURE OF THE PROPOSED PROJECT

Alternative A (Proposed Action) - Ruby Creek Drill Site and Access Route

Phillips proposes to directionally drill a 12,520-foot exploratory oil/gas well on the Beartooth Ranger District, Custer National Forest, Carbon County, Montana. The drilling proposal is located in the Ruby Creek drainage, a tributary to the Clarks Fork of the Yellowstone River. The drill site is located in the NW1/4 NW1/4 Sec 15, T9S, R20E. Access to the proposed site would utilize 4.3 miles of Montana State Highway 72 south from Belfry, Montana, to Grove Creek Road, an existing improved county road. From this point, access would head west towards the drill site, utilizing 5.0 miles of Grove Creek Road and approximately 8.0 miles of existing unimproved "two-track" roads to the Custer National Forest boundary (Forest boundary).

Access to the Forest boundary would traverse BLM-administered land and land under private ownership. From the Forest boundary, access would utilize approximately 0.8 miles of unimproved two-track road to its terminus. To reach the drill site from this point would require approximately 0.3 miles of new road construction. Phillips proposes to construct a 1.7-acre drill pad. Disturbance associated with this alternative would include 21.3 acres of existing road reconstruction (two-track), 1.5 acres of new road construction, a 1.7-acre drill pad, and 0.8 acres of cut and fill slopes and topsoil stockpile associated with the drill site. Total disturbance would be 25.3 acres.

Alternative A Access Route Variations

To assist in the FS and BLM decision-making process, three access route variations to the proposed drill site (Alternative A) were considered in the analysis of this alternative. The purpose of the analysis is to provide a contrast in management opportunities and environmental impacts that would assist the agencies in the decision-making process. These variations are summarized in the following sections.

Proposed Action (Variation A1)

This variation is Phillips' proposed access route to the Ruby Creek drill site described previously.

Meeteetse Trail - Robertson Draw Access Route (Variation A2)

The Meeteetse Trail - Robertson Draw Access Route variation follows the county improved Grove Creek Road to its terminus for 5.0 miles from Montana Highway 72.

From the end of the Grove Creek Road, this access route follows unimproved two-track roads for approximately 1.1 miles to the Meeteetse Trail road and then follows this road for approximately 5.1 miles to its convergence with the Robertson Draw Road. From this point the access route follows the Robertson Draw Road for 5.7 miles to a point where an unimproved two-track road heads north toward Mill Draw. The access route follows this two-track road to Mill Draw where it converges with Phillips' proposed access route. From this point, this access route variation is identical to Phillips' proposed access route. This variation would involve 5.0 miles of the improved county Grove Creek Road requiring no reconstruction, 10.8 miles of improved county road (Meeteetse Trail and Robertson Draw Road) requiring minor reconstruction, 6.8 miles of unimproved two-track road requiring major reconstruction, and 0.3 miles of new road construction.

Southern Access - Robertson Draw Access Route (Variation A3)

The Southern Access - Robertson Draw Access Route variation would originate from Montana Highway 72 approximately 2.2 miles north of the Wyoming border. The access route follows a county road for 1.5 miles across the Clarks Fork to the Robertson Draw Road. From this point access to the drill site would be identical to the Meeteetse Trail -Robertson Draw Access Route (Variation A2) described previously. This variation would involve 1.5 miles of county improved road requiring no reconstruction, reconstruction or new construction of the bridge over the Clarks Fork, 5.7 miles of improved county road (Robertson Draw Road) requiring minor reconstruction, 5.7 miles of unimproved two-track road requiring major reconstruction, and 0.3 miles of new road construction.

Clark Wyoming Access Route (Variation A4)

The Clark Wyoming access route variation originates from Wyoming Highway 120 approximately 8.6 miles south of the Montana border. From this point the access route follows an improved county road for approximately 2.0 miles towards Clark, Wyoming, to an intersection with county road 8WC where the route turns north along this road for 2.4 miles to the intersection with county road 8VC. The access route follows this road west for approximately 0.5 miles to an intersection with a graded dirt road heading north to the Joanne Ranch. The access route heads north on this route for 6.1 miles along unimproved two-track roads to the Robertson Draw Road where this access route converges with Variations A2 and A3 and then follows Variation A2 and A3 routes to the drill site. This variation would involve 7.6 miles of county improved road requiring no reconstruction, 10.1 miles of unimproved two-track road requiring major reconstruction, and 0.3 miles of new road construction.

Alternative B - Gold Creek Drill Site and Access Route

The Gold Creek drill site is located in the Gold Creek drainage in the SW1/4 NE1/4 Sec 10 T9S R20E. Access to this site would utilize the same route as described under the proposed action to the terminus of Grove Creek Road. From that point, access would head west utilizing existing unimproved two-track roads leading to Gold Creek for 5.3 miles to an abandoned drill site. An additional 0.9 miles of new road construction would be required to access the drill site from this point, of which 0.5 miles would occur on Forest land. A 2.2-acre drill pad would be constructed at the Gold

Creek drill site. Disturbance associated with this alternative would include 12.9 acres of existing road reconstruction (two-track), 4.4 acres of new road construction, a 2.2-acre drill pad, and 0.8 acres of cut and fill slopes and topsoil stock pile associated with the drill site. Total disturbance would be 20.3 acres.

ENVIRONMENTAL CONSEQUENCES

Introduction

Clearing vegetation and disturbing soils during construction of the access road and drill site would directly impact general vegetation and related resources. Except for riparian cottonwood and willow scrub, a reduction in the areal cover of vegetation community types affected would be a negligible impact since these communities are common, have wide distribution, and occur with high frequency within the general project area. Disturbances to wetlands could require administrative coordination with the Department of Army Corps of Engineers (COE) pursuant to the federal Clean Water Act. Section 404 permit(s) could be required. The COE, based on the exact nature of the disturbance activity and site-specific conditions, would determine the type of permit (Individual, Regional, or Nation Wide) required according to the rules and regulations presented in the Federal Register (1986).

The duration of impacts depends on the time required for natural succession to return revegetated areas to predisturbance conditions. Vegetation cover types within the project area primarily have poor to fair revegetation potentials, with some small isolated areas having a good potential as itemized in the Soils Section of Chapter 3 and 4. Revegetation could stabilize most disturbances within one or two years. Construction activities could introduce undesirable and noxious weed species into an otherwise weed-free area. These weeds often out-compete the more desirable species, rendering the site less productive as a source of forage for livestock and wildlife. Sites dominated by weeds often take on a different visual character that may be in visual contrast with surrounding undisturbed vegetation.

Construction and operation of the proposed project would not directly or indirectly affect the quality or integrity of the proposed Meeteetse Spires Preserve since road construction activities are not proposed within the proposed preserve area. No surveys for plant species of concern were completed for the project due to the late season when work initiated for this EIS; therefore, specific impacts to the species listed in Table C-2 are unknown. Only the species that inhabit sagebrush scrub and/or limber pine woodland could be potentially impacted.

Construction of this project could result in a reduction in livestock and wildlife forage and a subsequent reduction of animal unit months (AUMs) in the Grove Creek Allotment. See the Vegetation Section of Chapter 3 for a description of the Grove Creek Allotment. For the purposes of assessing impacts to range resources, acres of disturbance were converted to reduction in AUMs based on an average of five acres per AUM for the Grove Creek Allotment. USDI-BLM (1983) indicates an average of seven acres per AUM on the allotment.

The following criteria were used to determine the significance of impacts to vegetation resources due to the proposed action or alternatives:

General

- Implementation of the proposed action or alternatives would violate management direction and/or management area direction as described and mandated by the Custer National Forest LRMP and EIS (USDA-FS 1986b) and the Billings BLM Resource Area RMP (USDI-BLM 1983).

General Vegetation

- Following reclamation, areas not having an adequate cover of vegetation within five years to stabilize the site to predisturbance erosion conditions or the species composition to support pre-existing land use including grazing, wildlife habitat, recreation, and agricultural operations. The following performance standards were used to determine whether revegetation has been successfully attained:

  1) Percent Cover: 75 percent of the total vegetal cover measured for the reference transect (i.e., baseline conditions).

  2) Dominant Species: 90 percent of the revegetation consists of species contained in the applied seed mix and/or that occur in the reference transect.

  3) Seedling Density: the density and abundance of seedlings is at least three to four seedlings per linear foot.

  4) Grazing Utilization: The grazing utilization rating is not worse than moderate.

- Discharge of dredge or fill into wetland areas (as determined using the Department of Army Corps of Engineer's wetlands delineation manual) and/or the reduction of wetland area in the project area that lasts in the long-term.

- Introduction and establishment of noxious and undesirable weedy plant species precluding successful revegetation with desirable species within five years.

Plant Species of Special Concern

- Reduction in numbers of individuals of plant species of special concern or disturbance of suitable habitat judged important to the survival of those species. These species include federally listed threatened and endangered species, federal candidate species for listing (candidate 1 and/or 2 species), or species considered rare or important by the Montana Heritage Inventory Program.

Timber Resources

- Removal of commercially valuable timber or stands where timber stand improvements have been implemented, where monetary reimbursement for the

loss of timber and improvement investments would not substantially compensate for the loss.

Range Resources

- Reduction in AUMs on any grazing allotment by five percent or more.
- Disruption of critical ranching operations such as calving, livestock trailing, maintenance of control or separation of livestock, maintenance of stock watering sources, and the ability to use the range in a normal manner.
- Death of range livestock due to vehicle/animal contact associated with project activities.

Direct and Indirect Impacts

Alternative A - Proposed Action

Access Route

Reconstruction of unimproved two-track roads from the county road to the terminus of the existing two-track road would involve clearing an average of ten feet on each side of the existing road surface. Over the 8.8 miles of access route, this clearing would represent approximately 20.6 acres within the sagebrush scrub vegetation cover type and 0.7 acres in the limber pine woodland cover type. Approximately 0.3 miles of new road construction to the drill site would involve clearing a 40-foot-wide construction right-of-way (ROW) through limber pine woodland. This would result in clearing approximately 1.5 acres of limber pine woodland. The reduction of these cover types due to clearing would not be significant since these types cover vast areas within the region. Although revegetation potential is poor to fair for the areas that would be disturbed, successful revegetation is attainable and would require aggressive reclamation and erosion control techniques. A site-specific erosion control, revegetation, and rehabilitation plan for the project is presented in Appendix D of the DEIS.

The road would also cross the 30-foot-wide riparian zone associated with Ruby Creek and would require clearing approximately 0.02 acres of riparian cottonwood and willow scrub at the same point at which the existing unimproved trail crosses the creek. The existing trail crosses the riparian zone with a low water crossing. Although this wetland type is protected by the Clean Water Act and is relatively rare in the region, the loss of 0.02 acres would not be considered significant or in violation of Management Area M directives since an existing trail already has disturbed the wetland at this point, and there would not be a significant reduction in the functional values provided by this wetland. Placement of a sufficiently sized culvert and minimization of the amount of riparian zone affected would minimize impacts to levels not considered significant.

As with any development, construction and increased activity associated with this project could introduce noxious weeds into an otherwise weed-free area. Such an invasion would be considered significant. Monitoring for noxious weed invasion along the access road and immediate control would preclude the occurrence of this significant

impact. The FS would be responsible to ensure that Phillips monitors for noxious weeds and, if necessary, designs and implements eradication measures. Monitoring and eradication of noxious weeds would be a requirement of the reclamation bonding process.

During the field reconnaissance of the project area, no species of special concern itemized in Table C-2 were identified. Since no surveys for plant species of special concern have been completed during the growing and/or flowering season, the impact to species of special concern is unknown. Only the species listed in Table C-2 that inhabit sagebrush scrub or limber pine woodland would potentially be impacted. A clearance survey prior to construction would be required to determine if any of the species would be impacted.

The 21.3 acres of vegetation clearing along the existing unimproved two-track roads within the Grove Creek allotment would cause a reduction of approximately 4.3 AUMs, or 0.3 percent of the total AUMs contained on the 23,507-acre allotment. This reduction in AUMs would not be significant according to the significance criteria previously listed. Similarly, the vegetation clearing on Forest land associated with new road construction would not significantly reduce the amount of forage available to wildlife.

No significant impacts are anticipated to occur due to implementation of any of the Alternative A routing variations. The type and magnitude of impacts would be similar to those described previously for Phillips' proposed access. The area of disturbance of each vegetation cover type is presented in Table C-3. The difference in disturbance between each variation (A3 - 15.5 acres, A2 - 18.0 acres, A1 - 22.8 acres, and A4 - 23.8 acres) would not be considered substantial in regard to the impacts discussed for Phillips' proposed access route. Variation A3 could impact the riparian zone of the Clarks Fork during bridge reconstruction or new bridge construction.

Drill Site

Construction of the 1.7-acre drill site would require clearing approximately 2.5 acres of limber pine woodland consisting mostly of grass, forbs, shrubs, and some scattered limber pine. The loss of this cover type and wildlife forage provided by this type would not be considered significant. In addition to vegetation clearing during construction, it is possible that additional vegetation in the immediate vicinity of the drill site could be adversely affected (defoliation and/or browning) or destroyed due to emission of H_2S during drilling and/or well testing, or due to emission of SO_2 during flaring. If such adverse impacts occurred, the area of impact would need to be revegetated. Revegetation could include reducing the acidity levels of the soil if found to be excessive by applying appropriate quantities of lime.

Although the drill site has a poor reclamation potential, successful revegetation is attainable with the aggressive reclamation and erosion control techniques listed in Appendix D of the DEIS. If producible quantities of oil or gas are not encountered, the drill site would be recontoured to the approximate original contour and reclaimed. Regraded cut and fill slopes would be retopsoiled, mulched, and revegetated per Appendix D of the DEIS. If producible quantities were encountered the drill site would be secured for a two- to three-year interim period while additional environmental analysis (i.e., environmental assessment and/or environmental impact statement) were conducted and the FS and BLM reached a decision concerning well production and field

development. During this time, all disturbed surfaces would be protected from surface runoff and erosion through the use of mulching, netting, matting, and/or revegetation depending on site-specific conditions. These measures are discussed in detail in the site-specific erosion control, revegetation, and rehabilitation plan presented in Appendix D of the DEIS. The same measures and techniques and therefore effectiveness of erosion control would be used under either scenario including dry-hole with full reclamation or the interim decision making period in the event producible quantities of oil/gas are encountered.

No wetlands would be impacted due to the construction and operation of the drill site. Noxious weeds could invade the site as previously discussed; however, with the close monitoring of weed invasion and immediate eradication, no significant impacts would likely occur. During the field review of the drill site, none of the plants itemized in Table C-2 were identified. Since no surveys for plant species of special concern have been completed during the growing and/or flowering season, the impact to species of special concern listed in Table C-2 that inhabit sagebrush scrub and/or limber pine woodland is unknown. A clearance survey prior to construction would be required to determine if any of these species would be impacted. Construction, operation, and abandonment of the drill site would not impact grazing or timber management for reasons discussed previously.

Alternative B - Gold Creek Site

Access Route

Implementation of this access road alternative would be very similar to that described under Alternative A. Approximately 10.2 acres of sagebrush scrub and 2.7 acres of limber pine woodland would be cleared due to reconstruction of the existing unimproved two-track roads from the improved county road to the abandoned Amoco drill site. This clearing would represent a loss of 2.6 AUMs, representing approximately 0.2 percent of the total AUMs on the Grove Creek Allotment. This impact would not be considered significant. From the abandoned Amoco drill site to this alternative drill site, approximately 0.9 miles of new access road would be constructed through limber pine woodland representing approximately 4.4 acres of clearing. In addition, approximately 0.03 acres of riparian zone associated with Gold Creek could be impacted due to road crossing and encroachment. These and associated impacts would not be considered significant for the same reasons as discussed under Alternative A.

Drill Site

Implementation of this alternative drill site would be very similar to that described under Alternative B. Construction of the 2.2-acre drill site would result in clearing approximately 3.0 acres of limber pine woodland. These and associated impacts would not be considered significant for the same reasons as discussed under Alternative A.

Table C-3. Disturbance[a] to Vegetation Cover Types Due to Road Construction and Reconstruction and Drill Pad Construction under Alternative A and Access Route Variations and under Alternative B.

ACTIVITY	Vegetation Cover Types[b] SS (mi)	SS (ac)	LP (mi)	LP (ac)	MC (mi)	MC (ac)	AF (mi)	AF (ac)	RI[c] (mi)	RI[c] (ac)	TOTAL Distance (mi)	TOTAL Area (ac)
ALTERNATIVE A												
Variation A1												
Road Reconstruction	8.5	20.6	0.3	0.7	0.0	0.0	0.0	0.0	<0.0>	<0.02>	8.8	21.3
New Road Construction	0.0	0.0	0.3	1.5	0.0	0.0	0.0	0.0	<0.0>	<0.00>	0.3	1.5
Subtotal	8.5	20.6	0.6	2.2	0.0	0.0	0.0	0.0	<0.0>	<0.02>	9.1	22.8
Drill Site	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	<0.0>	<0.00>	0.0	2.5
TOTAL	**8.5**	**20.6**	**0.6**	**4.7**	**0.0**	**0.0**	**0.0**	**0.0**	**<0.0>**	**<0.02>**	**9.1**	**25.3**
Variation A2												
Road Reconstruction	6.5	15.8	0.3	0.7	0.0	0.0	0.0	0.0	<0.0>	<0.02>	6.8	16.5
New Road Construction	0.0	0.0	0.3	1.5	0.0	0.0	0.0	0.0	<0.0>	<0.00>	0.3	1.5
Subtotal	6.5	15.8	0.6	2.2	0.0	0.0	0.0	0.0	<0.0>	<0.02>	7.1	18.0
Drill Site	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	<0.0>	<0 00>	0.0	2.5
TOTAL	**6.5**	**15.8**	**0.6**	**4.7**	**0.0**	**0.0**	**0.0**	**0.0**	**<0.0>**	**<0.02>**	**7.1**	**20.5**
Variation A3												
Road Reconstruction	5.5	13.3	0.3	0.7	0.0	0.0	0.0	0.0	<0.0>	<0.02>	5.8	14.0
New Road Construction	0.0	0.0	0.3	1.5	0.0	0.0	0.0	0.0	<0.0>	<0.00>	0.3	1.5
Subtotal	5.5	13.3	0.6	2.2	0.0	0.0	0.0	0.0	<0.0>	<0.02>	6.1	15.5
Drill Site	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	<0.0>	<0.00>	0.0	2.5
TOTAL	**5.5**	**13.3**	**0.6**	**4.7**	**0.0**	**0.0**	**0.0**	**0.0**	**<0.0>**	**<0.02>**	**6.1**	**18.0**

Table C-3. Continued.

ACTIVITY	Vegetation Cover Types[b] SS (mi)	SS (ac)	LP (mi)	LP (ac)	MC (mi)	MC (ac)	AF (mi)	AF (ac)	RI[c] (mi)	RI[c] (ac)	TOTAL Distance (mi)	TOTAL Area (ac)
ALTERNATIVE A												
Variation A4												
Road Reconstruction	8.9	21.6	0.3	0.7	0.0	0.0	0.0	0.0	<0.0>	<0.02>	9.1	22.3
New Road Construction	0.0	0.0	0.3	1.5	0.0	0.0	0.0	0.0	<0.0>	<0.00>	0.3	1.5
Subtotal	8.9	21.6	0.6	2.2	0.0	0.0	0.0	0.0	<0.0>	<0.02>	9.4	23.8
Drill Site	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	<0.0>	<0.00>	0.0	2.5
TOTAL	**8.9**	**21.6**	**0.6**	**4.7**	**0.0**	**0.0**	**0.0**	**0.0**	**<0.0>**	**<0.02>**	**9.4**	**26.3**
ALTERNATIVE B												
Road Reconstruction	4.2	10.2	1.1	2.7	0.0	0.0	0.0	0.0	<0.0>	<0.03>	5.3	12.9
New Road Construction	0.0	0.0	0.9	4.4	0.0	0.0	0.0	0.0	<0.0>	<0.00>	0.9	4.4
Subtotal	4.2	10.2	2.0	7.1	0.0	0.0	0.0	0.0	<0.0>	<0.03>	6.2	17.3
Drill Site	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	<0.0>	<0.00>	0.0	3.0
TOTAL	**4.2**	**10.2**	**2.0**	**10.1**	**0.0**	**0.0**	**0.0**	**0.0**	**<0.0>**	**<0.03>**	**6.2**	**20.3**

a - A 20-foot-wide construction zone assumed for reconstruction of existing unimproved roads; a 40-foot-wide construction zone assumed for construction of new road.

b - SS=sagebrush scrub; LP=limber pine woodland; MC=mixed conifer; AF=alpine bunchgrass and forbland; and RI=riparian cottonwood and willow scrub.

c - Disturbance within riparian zone is less than 0.1 acre. This magnitude cannot be resolved for the other vegetation cover types.

Impact Summary

Access Routes

Impacts that would occur with implementation of either alternative would be very similar. None of the impacts would be considered significant. Alternative A access would involve 5.5 acres of vegetation clearing in excess of Alternative B. Both alternatives would involve impacts to wetlands; however, Alternative A access would directly impact the riparian zone of Ruby Creek due to crossing while Alternative B would directly impact the riparian zone associated with Gold Creek due to crossing and potential encroachment. Impacts due to noxious weed invasion, potential impacts to species of special concern, and impacts to range and timber management would be the same for each alternative. Neither alternative would likely affect critical ranching operations. Reimbursement of ranchers for accidental death of livestock in the Grove Creek Allotment due to project-related vehicle collision would be a condition of the access road right-of-way permit or per agreement with private land owners. Successful reclamation and revegetation would be feasible for both alternatives; however, the high content of large boulders along the new road portion of Alternative B could hamper reclamation success as discussed in the Soils Section of this chapter. Table C-3 summarizes the cumulative areas of disturbance within the various vegetation cover types associated with each access alternative and access route variations. The proposed Meeteetse Spires Preserve would not be directly or indirectly impacted by either alternative. Neither of the access routes would violate current management direction as mandated by the Custer National Forest LRMP and EIS (USDA-FS 1986b) and the Billings Resource Area RMP (USDI-BLM 1983).

Drill Sites

Impacts that would occur with implementation of either alternative would be very similar. None of the impacts would be considered significant. Alternative B drill site would involve 0.5 acres of vegetation clearing in excess of Alternative A. Impacts due to noxious weed invasion, and potential impacts to species of special concern would be the same for each alternative and access route variation. Successful reclamation and revegetation would be feasible for both alternatives; however, the high content of large boulders at the Alternative B drill site could hamper reclamation success as discussed in the Soils Section of this Chapter. Table C-3 summarizes the cumulative areas of disturbance within the various vegetation cover type associated with each drill site alternative. Neither of the drill sites would violate existing management direction as mandated by the Custer National Forest LRMP (USDA-FS 1986b).

Cumulative Impacts

Existing land management activities that have impacted the vegetation of the project area to varying degrees primarily include grazing on non-Forest lands, road construction and use, and the abandoned Amoco drill site. In some areas grazing has been excessive, resulting in soil compaction, vegetal cover removal, and subsequent increase in soil erosion. The abandoned drill site has naturally stabilized and become covered by the invasion of native species. Overall, these impacts are not cumulatively significant and implementation of the proposed project would not significantly add to these impacts. Appendix B discusses impacts due to field development and suggests that no significant cumulative impacts to vegetation would be expected.

Mitigation Summary

Adverse impacts to vegetation and associated resources could be greatly reduced or avoided by revegetating all disturbed areas as soon as possible after construction through implementation of a site-specific revegetation, erosion control, and rehabilitation plan as itemized in Appendix D of the DEIS. Road construction should avoid wetland areas. If avoidance is not possible, the area of disturbance should be minimized. Only certified weed-free mulch should be used for erosion control and revegetation purposes. A monitoring program should be designed and implemented to detect noxious weed invasion as a condition of the reclamation bonding process. If an invasion is detected, eradication measures as described in the Custer National Forest Noxious Weed Implementation Plan EIS (USDA-FS 1986a) should be implemented immediately. Prior to road construction, all areas to be disturbed should be staked and surveyed for plant species of concern conducted during the growing and/or flowering seasons. If any of the species itemized in Table C-2 were found, the feasibility of re-routing or relocating areas that would be disturbed should be determined. All range improvement structures such as fences, cattleguards, and water developments should be left in functional condition so as to ensure current allotment management operations could continue.

Unavoidable Adverse Impacts

No unavoidable adverse impacts would occur under either alternative, assuming best management practices and specific mitigation measures listed in Appendix D of the DEIS are successfully implemented.

Comparative Analysis

Potential impacts to these resources directly relate to the clearing and disturbance of vegetation due to drill site and access road construction. Revegetation could be difficult due to low soil fertility and high coarse fragment contents. Wetlands are of particular importance as a sensitive and unique community type protected under the Clean Water Act. Range resources could be impacted through the reduction of forage, altered livestock movement and management, and increased potential for livestock/vehicle collision resulting in death. No significant impacts on these resources are expected, assuming recommended mitigation is implemented.

Important impact contrasts between Alternative A and Alternative B include the following: total disturbance to vegetation would involve 25.3 acres for Alternative A compared to 20.3 acres for Alternative B and 0.02 acres of riparian zone disturbance under alternative A compared to 0.03 acres under Alternative B. Impacts to the riparian zone could require coordination with the Department of Army Corps of

Engineers for a 404 permit pursuant to the Clean Water Act. As discussed under Soils, the probability for successful reclamation under Alternative A is higher than under Alternative B.

The potential impact to plant species of concern that occur in the project area is unknown since a survey along access routes and at drill sites could not be completed earlier in the year when positive identification was feasible. A survey would be required prior to project construction to determine if any of the species listed in Table C-2 occur in areas to be disturbed and if they did occur, what the appropriate and specific mitigation would entail.

The type and magnitude of impacts to vegetation would be similar for each of the Alternative A route variations. Variation A3 would disturb the least vegetation (15.5 acres), followed by A2 (18.0 acres), A1 (22.8 acres), and A4 (23.8 acres). Implementation of Variation A3 could impact the riparian zone along the Clarks Fork due to bridge construction or reconstruction. The proposed project would not violate existing management direction in regard to vegetation and associated resources.

Irreversible and Irretrievable Commitment of Resources

The term irreversible commitment of resources describes the loss of future options. This primarily applies to the effects of using non-renewable resources (e.g., minerals or cultural resources) or to processes or factors (e.g., soil productivity) that are renewable only over long periods of time. The term irretrievable commitment of resources refers to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is irretrievably lost while an area serves as a winter sports site. The production lost is irretrievable, but the action is not irreversible; if use changes, timber production could resume.

The only potential irreversible commitment of resources that could occur to vegetation would be the direct mortality of individual plants due to project construction or during gas flaring. Plants as populations and communities, however, have the reproductive capacity to renew themselves. Consequently, no irreversible commitment of resources would occur to vegetation and associated resources as a whole. The interim loss of vegetation cover types during project implementation would be a minor irretrievable commitment of resources.

MITIGATION AND MONITORING

The mitigation measures and monitoring requirements that follow will be included in the Conditions of Approval for the drilling proposal if project approval is granted. The measures and requirements were developed in response to impacts identified in the Environmental Consequences chapter (Chapter 4) of the DEIS and through issues identified during the scoping process. The measures and requirements describe how drilling will be managed to assure compliance with the resource management goals and objectives of the Custer National Forest Land and Resources Management Plan (USDA-FS 1986), applicable lease stipulations, and resource limitations identified during interdisciplinary analysis. The following measures and requirements apply to Alternatives A and B unless otherwise noted. If deemed necessary in light of new facts or to minimize impacts, the following measures may be added to, modified, or selectively withheld. The Authorized Officer (AO) will determine final mitigation measures and monitoring requirements after consultation with the interdisciplinary team (IDT), who will have made recommendations based upon on-the-ground situation analysis.

Administrative

- Conduct all operations in full compliance with applicable laws and regulations and the approved Application for Permit to Drill (APD, which includes the H_2S Contingency and Evacuation Plan).

- Phillips will adhere to applicable lease stipulations during all phases of the proposed drilling activity, or provide for written waiver of the stipulation(s) where adherence is not possible but acceptable with proper mitigation.

- Guide all phases of Phillips' exploratory drilling proposal, including road and drill site construction and maintenance and rehabilitation, by the dictates of the Clean Water Act. Control accidental discharge of all hazardous substances, including fuels, by methods described in a spill prevention and containment plan to be prepared by Phillips. Protect completely all single tanks of 660 gallons or larger and any aggregate of containers totalling 1,320 gallons or more.

- Utilize the Soil and Water Conservation Handbook (FS Handbook 2509.22, May 1988) and the Surface Operating Standards for Oil and Gas Exploration and Development (USDI-BLM and USDA-FS 1988) for reference to best management practices relating to road construction, drill pad construction, containment of drilling fluids and produced fluids and gases, and handling of all products and by-products of oil drilling.

- Phillips will submit for approval an access road design plan using roading guidelines approved for use by the Custer National Forest before starting construction.

- Phillips will submit for approval a road improvement plan for existing roads within the project area intended for use as part of exploratory drilling activities. The road improvement plan will specify road work needed to accommodate exploratory drilling activities. The plan will be agreed to in advance of any road improvement work by Phillips, the Bureau of Land Management (BLM) right-of-way requirements, and the Forest Service (FS). Phillips will schedule a review of this plan a minimum of 14 days in advance of anticipated start work date. Construction, reconstruction, and maintenance activities on county roads in the project area will be in accordance with a Memorandum of Understanding between Carbon County and Phillips.

- Phillips will prepare and submit a comprehensive drill site design plan to the BLM and FS for approval prior to initiation of construction. This plan will show the layout of the drill pad over the existing topography, dimensions of the pad, volumes and cross sections of cut and fill, location and dimensions of the cuttings trench, and access road egress and ingress.

- Phillips will slope-stake all construction activities and receive approval by the FS prior to start of construction.

- Require a qualified inspector to be on-site during all construction and reconstruction activities to assure contractor compliance with approved road and drill site design plans. Phillips will provide the qualified inspector.

- Construction and implementation of Phillips Ruby A Federal No. 1-9 Exploratory Oil/Gas Well project would be required to conform to specific measures and guidelines presented in the Land and Resource Management Plan for the Custer National Forest. In addition, the following mitigation recommendations would reduce impacts to vegetation and related resources. Measures listed in the Soils, Water Resources, and Visual Resources technical reports also apply to vegetation mitigation.

Preconstruction Planning

- All construction, drilling, and reclamation activities should be conducted in accordance with the site-specific Erosion control, Revegetation, and Rehabilitation Plan (ERRP) presented in Appendix D of the DEIS.

- Phillips should coordinate with the Department of Army Corps of Engineers and Environmental Protection Agency on wetlands mitigation, if required, for riparian and wetland areas affected by project implementation. Disturbance to wetland and riparian areas along all portions of the access road, and in particular within the stream environment (within 100 feet of the floodplain or stream) should be minimized.

- The staked road route should be surveyed prior to commencement of construction activities for plant species of concern (Table C-2) and their preferred habitat. Such a survey should occur during the flowering/fruiting time. A window from early to mid-June should be considered for the survey time. All occurrences of species of concern or their preferred habitat should be noted during the survey, and construction activities should avoid habitats preferred by or containing sensitive plant species. The survey efforts and results should be coordinated with the Rocky Mountain Task Force of the Nature Conservancy and the MTNHP.

- Prior to the start of construction and after construction staking, Phillips should submit a site-specific reclamation plan to the FS and BLM for approval. The plan should include provision for the establishment of a reclamation monitoring program.

Construction Measures

Vegetation Clearing and Topsoil Removal and Handling

- Brush (shrub) clearing along the margins of the access road right-of-way (ROW) during construction should be limited to trimming, scalping, and/or crushing to avoid disturbing root systems. This measure would be effective in limiting the amount of shrub vegetation disturbed along the ROW. By not disturbing the root system, some crushed, scalped, or clipped shrubs will resprout and revegetate the ROW more quickly. This would reduce soil erosion and speed restoration of wildlife habitat. Any blading should require authorization in advance.

- Within the mixed conifer vegetation type and other areas with large woody shrubs (willow) or trees (limber pine, aspen and cottonwood) and prior to earth work with dozers and graders, the ROW should be precleared of all woody vegetation greater than 2 inches in diameter and should be disposed of as approved by the FS, BLM, and Carbon County.

- When timber is cleared, all tree stumps should be cut as low as practical but not higher than 14 inches. The trees should be limbed and stacked at the edge of the ROW area. During cleanup, all clearing and grubbing debris (slash) should be piled for burning or burial as specified by the Authorized Officer (AO).

- Topsoil or the best available medium for plant growth should be stripped off prior to construction, reserved, and respread over disturbed areas following recontouring. Topsoil should be stripped to a sufficient depth to provide adequate quantities of topsoil to be spread to a minimum depth of six inches over the disturbed areas to be reclaimed. All topsoil should be stored separately from subsoil and fill material to preclude contamination or mixing.

- On slopes less than 30 percent, the topsoil should be bladed to the margins of the ROW and stockpiled there for later redistribution over the disturbed areas. Topsoil should also be removed from fill areas which undergo scarification or benching prior to placement of fill. If all topsoil can not be feasibly stored along the margins of the ROW, small topographic benches located along the access road could serve as topsoil stockpile areas if storing topsoil along the road proves infeasible.

- Use of existing or constructed roads should be maximized for vehicle travel where possible. Generally, no off-road use of vehicles or equipment should be allowed, especially in streambeds and other fragile areas without approval of the AO in conjunction with regulatory agencies.

Livestock Control and Site Protection

- Existing livestock control structures such as fences and cattleguards should be maintained. Where access requires the disruption of an existing fence, a cattleguard should be installed to maintain functional integrity.

- If a natural barrier used to control livestock is broken during construction, Phillips should adequately fence the area to prevent drift of livestock. All fencing constructed by Phillips should meet FS and BLM design requirements with input from the Montana Department of Game and Fish. Fence specifications should be determined on a case-by-case basis.

Reclamation Measures

- The objectives of revegetation and reclamation should include:

  Short-Term (Temporary Reclamation):

  - Immediately stabilize the disturbed areas by mulching and runoff and erosion control and through the initiation of new vegetation.
  - Control and minimize surface runoff, erosion, and sedimentation through the use of diversion and water treatment structures.

  Long-Term (In addition to Temporary, Final Reclamation):

  - Restore primary productivity of the site and establish vegetation that will provide for natural plant and community succession.
  - Establish a vigorous stand of desirable plant species that will limit or preclude invasion of undesirable species, including noxious weeds.
  - Revegetate the disturbed areas with plant species useful to wildlife and livestock.
  - Restore disturbed area to prior aesthetic characteristics and values.

- The following performance standards should be used to determine whether the objectives of the ERRP have been met at a given time:

  All Years:

  - protective cover - all disturbed areas to be left bare, unprotected, or unreclaimed for more than one month will have at least a 50 percent cover of protective material in the form of mulch, matting, or vegetative growth. This does not apply to work areas.

  Second Year (Final Reclamation):

  - seedling density - the density and abundance of desirable (i.e., species) seedlings is at least 3 to 4 seedlings per linear foot of drill row (if drilled) or transect (if broadcast).
  - percent cover - total vegetal cover will be at least 50 percent of predisturbance vegetal cover as measured along the reference transect for establishing baseline conditions.

By the Fifth Year (Final Reclamation):

- o percent cover - total vegetal cover will be at least 80 percent of predisturbance vegetal cover as measured along the reference transect for establishing baseline conditions.

- o dominant species - 90 percent of the revegetation consists of species included in the seedmix and/or that occurs in the surrounding natural vegetation as measured along the reference transect for establishing baseline conditions.

- o erosion condition/soil surface factor - erosion condition of the reclaimed area is equal to or in better condition than that measured for the reference transect for establishing baseline conditions.

Site Preparation, Topsoil Respreading, and Seedbed Preparation

- o In preparation for seeding, topsoil should be spread to a minimum depth of six inches over the drill site and road ROW cut and fill surfaces. A trackhoe or similar equipment with a long-reach and side-cast capability should be used to backfill and respread topsoil on slopes greater than 40 percent.

- o If the topsoil is compacted upon respreading, it should be loosened and smoothed either after or in conjunction with fertilization as directed by the AO. If the topsoil is loose, it should be compacted to provide a firm seedbed. On slopes steeper than 40 percent, respread topsoil should be prepared by loosening or compacting where possible with the trackhoe.

Fertilization

- o The results of the topsoil fertility analysis presented in the Soils Technical Report indicate that topsoil has low fertility levels. To mitigate fertility deficiencies, nitrogen, phosphorus, and potassium should be applied. The fertilizer should be in a time-release form. Fertilizer application should occur either prior to or in conjunction with seedbed preparation unless otherwise directed by the AO. Fertilization rate may require adjustment if mulch is to be incorporated into the soil.

Seeding

- o After completion of seedbed preparation, the seed mixes presented in Tables C-4, C-5, and C-6, or similar mixes as directed by the AO, should be applied to appropriate areas. Table C-4 presents an appropriate seed mix for temporary revegetation of cut and fill slopes associated with the drill site and access road as well as topsoil stockpiles. Table C-5 is a seed mix for final reclamation revegetation for upland areas. Table C-6 presents a seed mix for final reclamation of riparian areas affected by project implementation.

Table C-4. Seed Mix[1] for Temporary Revegetation of Cut and Fill Slopes Associated with the Drill Site and Access Road as well as Topsoil Stockpiles.

Species	Cultivar or Variety	Seed Application Drilled Rate (PLS[2] lbs/ac)	Planting Depth (in)
Grasses:			
Mountain brome	Bromar	3.0	0.5
Intermediate wheatgrass	Oahe	3.0	0.5
Slender wheatgrass	San Luis, Revenue Primar	2.5	0.5
Sheep fescue	Covar	1.0	0.5
Forbs:			
Lewis flax	-	0.5	0.25
Sainfoin	Eski	1.0	0.5
Yellow sweetclover	-	1.0	0.25
Shrubs:			
None			
		12.0	

Suggested Alternate Species[3]	Replaces
Grasses: Smooth brome	Mountain brome
Thickspike wheatgrass	Intermediate wheatgrass
Hard fescue	Sheep fescue
Forbs: Sainfoin	Utah sweetvetch
White sweetclover	White yarrow
Yellow sweetclover	Lewis flax
Shrubs: None	

1- Seed mix based on objectives previously listed: adaptation to project site conditions, usefulness for site stabilization, species success in revegetation efforts, and current seed availability and cost

2- PLS = pure live seed. If broadcasted, rates should be increased by a factor of 2.5

3- Replacement species if suggested species are not available (substitution, if necessary, will be directed by the Authorized Officer)

Table C-5. **Seed Mix[1] for Final Reclamation of Upland Areas.**

Species	Cultivar or Variety	Seed Application Drilled Rate (PLS[2] lbs/ac)	Planting Depth (in)
Grasses:			
Mountain brome	Bromar	2.0	0.5
Western wheatgrass	Rosanna	1.5	0.5
Bluebunch wheatgrass	Secar	1.5	0.5
Idaho fescue	Joseph	1.0	0.25
Needle-and-thread	-	2.0	0.5
Sheep fescue	Covar	0.5	0.25
Forbs:			
Cicer milkvetch	Lutana, Monarch	0.5	0.25
Lewis flax	-	0.5	0.25
Rocky Mountain penstemon	-	0.5	0.25
White yarrow	-	0.5	0.25
Silky Lupine	-	1.5	0.5
Shrubs:			
Bitterbrush	-	2.0	0.5
Black sagebrush	-	0.5	0.25
Fringed sagebrush	-	0.5	0.25
Mountain big sagebrush	-	0.5	0.25
		16.5	

Suggested Alternate Species[3]		Replaces
Grasses:	Hard fescue	Sheep fescue
	Slender wheatgrass	Bluebunch wheatgrass
	Columbia needlegrass	Needle-and-thread
	Indian ricegrass	Idaho fescue
	Salina wildrye	Mountain brome
Forbs:	Sainfoin	Scarlet globemallow
	White sweetclover	Northern sweetvetch
	Yellow sweetclover	Cicer milkvetch
	Rocky Mountain penstemon	Silky lupine
Shrubs:	Prairie sage	Fringed sagebrush
	Wyoming big sagebrush	Mountain big sagebrush
	Rubber rabbitbrush	Black sagebrush

1- Seed mix based on objectives previously listed: adaptation to project site conditions, usefulness for site stabilization, livestock and wildlife use, species success in revegetation efforts, and current seed availability and cost

2- PLS = pure live seed. If broadcasted, rates should be increased by a factor of 2.5

3- Replacement species if suggested species are not available (substitution, if necessary, will be directed by the Authorized Office

Table C-6. Seed Mix[1] for Final Reclamation of Riparian Areas.

Species[2]	Cultivar or Variety	Seed Application Broadcast Rate (PLS[3] lbs/ac)
Grasses:		
Tufted Hairgrass	-	4.0
Alpine bluegrass	-	4.0
Redtop bentgrass	-	4.0
Meadow foxtail	-	6.0
Forbs:		
White Dutch clover	-	2.0
Alsike clover	-	2.0
Wild geranium	-	3.0
Shrubs:		
Golden currant	-	1.0
Woods wildrose	-	3.0
		29.0

1- Seed mix based on objectives previously listed: adaptation to project site conditions, usefulness for site stabilization, species success in revegetation efforts, livestock and wildlife use, and current seed availability and cost

2- If a species is not available, then increase seed application rate proportionately for each available species

3- PLS = pure live seed

- Seed should preferably be applied in the fall with drill-type of equipment. Where the topography of the disturbed areas does not allow drill-type of equipment such as on slopes in excess of 40 percent, seed should be broadcast applied at 2.5 times the application rate of drilled seed. A spike-toothed harrow or similar equipment should be used to cover the broadcast seed. Some areas may require covering seed by hand.

- Design and implement a noxious weed control program to detect noxious weed invasion. If an invasion is detected, implement eradication measures immediately.

Mulching

- The seeded cut and fill shoulders of the access road should be mulched to protect the soil surface against soil erosion, reduce evaporation and soil temperature fluctuations, and increase surface water infiltration and seedling germination and establishment. On slopes less than 30 percent, straw mulch should be applied and crimped into the soil surface.

- Use only certified weed free straw mulch. Certification should be provided by the county extension agent of the county in which the straw was grown. Plastic netting and or tackifiers should be used to secure the mulch in areas of high wind exposure and/or steep slopes. Hydromulching or degradable matting techniques should be used on slopes in excess of 40 percent or on slopes exceeding the operating capabilities of the machinery.

- Immediately mulch disturbed areas to be left unreclaimed for more than 2 weeks to prevent soil loss. Mulch should be thoroughly tacked down with a biodegradable tackifier or netting. This mulch is only a temporary measure to hold the soil until planting takes place and should be incorporated into the soil or removed prior to seeding.

Erosion Control

- The riparian zone of stream crossing should be rehabilitated immediately after construction is completed. Until riparian vegetation is re-established, the disturbed area should be protected by installation of sediment filters between the water edge and the disturbance on each side of the stream to prevent sediment contamination of the stream and/or erosion of the banks.

Abandonment Measures

- Phillips should notify the FS and the BLM that reclamation and rehabilitation have been completed. At that time, a joint compliance check of the ROW should be made by Phillips and the AO or designated representative to determine compliance with the terms and conditions of the use authorization. Phillips should coordinate with the FS and BLM for any required modifications or additional reclamation work for compliance with such terms and conditions.

Monitoring

- Permanent photomonitoring points should be established at appropriate vantage points which provide adequate visual access along the temporary access road and at the drill site.

- Phillips should be required to design and implement a monitoring program to evaluate the progress of the revegetation and restoration program. Both qualitative and quantitative monitoring should continue after reclamation until the reclaimed areas are released by the AO. Monitoring should require establishment of randomly located permanent quadrats in undisturbed areas representative of predisturbance conditions for each habitat type. Percent cover for each cover type (bare, rock, litter, grass, forb, shrub and tree) and by species should be determined in randomly placed subplots nested within each quadrat.

- Monitoring should take place once annually (end of growing season) for at least five years or until revegetation goals are met. A designated official of Phillips and the AO should inspect and review the condition of the site, assess the success and prognosis of all runoff and erosion control measures and revegetation efforts, and evaluate fugitive dust control needs. Photographs should be taken each year to document the progress of the reclamation program. The following are specific items which should be looked for during inspection:

    - noxious weed invasion
    - degree of herbivory by rodents or lagomorphs on seed and seedlings
    - revegetation success
    - locations of unauthorized off-road vehicle (ORV) access
    - sheet and rill erosion
    - soundness and effectiveness of erosion control measures
    - soundness and effectiveness of ORV control structures
    - condition of fence surrounding drill site

- An annual report describing the quantitative and qualitative findings of the annual inspection, photographs taken at each photomonitoring point, prognosis of the reclamation effort, and discussion and results of any remedial measures directed by the AO during the year should be prepared and submitted each year to the Forest Service and BLM AO. If monitoring of site conditions identifies areas of concern, Phillips should incorporate within the annual report what measures should be taken to mitigate the problem(s). The site should be monitored until it is released by the AO upon attainment of predisturbance vegetative cover as prescribed by the performance standard.

- Phillips should design and implement a control program if the Forest Service determines noxious weed invasion to be a problem. If pesticides are required, Phillips should prepare and submit a "Pesticide Use Proposal" consistent with federal and state laws and regulations concerning the use of pesticides (insecticides, herbicides, fungicides, rodenticides, and other similar substances), and existing management objectives and standards to the AO for approval prior to use.

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APPENDIX A

Montana Natural Heritage Program Data Files for Plant Species of Concern within the Meeteetse Spires Preserve

Montana Natural Heritage Program
Element Occurrences: Vicinity of Phillips Petroleum Ruby A Federal 1-9, Carbon County, Montana

EOCODE: PDAPI26010.001 SURVEY SITE: MEETEETSE SPIRES
NAME: SHOSHONEA PULVINATA GRANK: G263 SRANK: S1 FEDERAL STATUS: C2
COMMON NAME: SHOSHONEA LAST OBSERVATION: 1986-06-24 PRECISION: SC
EORANK: A EORANK COMMENTS: THREE LARGE, UNDISTURBED SUBPOPULATIONS.
MANAGED AREAS: PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
BLM: BILLINGS RESOURCE AREA, MILES CITY DISTRICT
COUNTY: CARBON
QUAD NAME: TOLMAN FLAT QUAD CODE: 4510912
TOWNRANGE: 008S020E SECTION: 26 TRS COMMENTS: N2NW4,E2SW4:23W2
LATITUDE: 450629 LONGITUDE: 1091339 PHYSICAL PROVINCE: MR
WATERSHED: 10070006 ELEVATION: 7140 ACREAGE: 50
DIRECTIONS: CA. 5 AIR MILES SSE. OF RED LODGE: HWY. 308 FROM BRIDGER TO BELFRY, THEN HWY. 397 S. 4.5 MI. TO GROVE CR. RD.: WEST 5 MI. TO RANCH, THEN LEFT, RT. AND ACROSS S. FORK GROVE CREEK.
HABITAT DESCRIPTION: GRAVELLY LIMESTONE SOILS ON WINDBLOWN RIDGETOPS, AMONGST SCATTERED PINUS FLEXILIS & PSEUDOTSUGA MENZIESII: WITH ERITRICHIUM HOWARDII, CYMOPTERUS HENDERSONII, KELSEYA.
ELEMENT DATA: EST. 6000-8000 PLANTS; THREE VERY LARGE, VIGOROUS SUBPOPULATIONS, WITH THE ELEMENT AS THE DOMINANT GROUND SPECIES IN MANY PLACES: SITES ARE ALMOST COMPLETELY UNDISTURBED, WITH NO WEEDS: EST. 3000-4000 PLANTS IN SOUTH SUBPOPULATION.
BEST SOURCE: SHELLY, J.S. 1986. FIELD SURVEYS IN CARBON COUNTY OF 23-27 JUNE: WITH P. LESICA.
COMMENTS: RECENTLY DESCRIBED GENUS AND SPECIES (SYST. BOT. (1982) 7: 471); LESICA, P. (3417), 1985, SPECIMEN #102363 MONTU.

EOCODE: PDAST530M0.002 SURVEY SITE: GROVE CREEK
NAME: HYMENOXYS TORREYANA GRANK: G? SRANK: S1 FEDERAL STATUS:
COMMON NAME: TORREY BITTERWEED LAST OBSERVATION: 1986-06-24 PRECISION: SC
EORANK: B EORANK COMMENTS: SMALL POPULATION, BUT HABITAT UNDISTURBED.
MANAGED AREAS: PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
COUNTY: CARBON
QUAD NAME: TOLMAN FLAT QUAD CODE: 4510912
TOWNRANGE: 008S020E SECTION: 23 TRS COMMENTS: W2W2
LATITUDE: 450702 LONGITUDE: 1091402 PHYSICAL PROVINCE: BH
WATERSHED: 10070006 ELEVATION: 7100 ACREAGE: 15
DIRECTIONS: TAKE HWY 308 FROM RED LODGE ABOUT 5 MILES TO JUST PAST STRIP MINE. FOLLOW UNIMPROVED ROAD SOUTH OF HIGHWAY ABOUT 6 MILES TO NORTH FORK OF GROVE CREEK.
HABITAT DESCRIPTION: LIMESTONE LITHOSOL; PSEUDOTSUGA MENTZEISII/PINUS FLEXILIS FELLFIELD, WITH SHOSHONEA PULVINATA, ERITRICHIUM HOWARDII, POTENTILLA FRUTICOSA.
ELEMENT DATA: 101-1000 PLANTS; IN FLOWER AND IMMATURE FRUIT; NO EVIDENCE OF DISTURBANCE.

BEST SOURCE: LESICA, PETER. DEPT. OF BOTANY, UNIV. OF MONTANA, MISSOULA, MT 59812.
COMMENTS: VOUCHER-LESICA, P. (3895), 1986. UM. BORDERS PHYSPROV MR.

Montana Natural Heritage Program
Element Occurrences: Vicinity of Phillips Petroleum Ruby A Federal 1-9, Carbon County, Montana

EOCODE: PDAST9C0M0.001 SURVEY SITE: MEETEETSE SPIRES
NAME: TOWNSENDIA SPATHULATA GRANK: G3 SRANK: S2 FEDERAL STATUS: 3C
COMMON NAME: SWORD TOWNSENDIA LAST OBSERVATION: 1986-06-24 PRECISION: SC
EORANK: B EORANK COMMENTS:
MANAGED AREAS: BLM: BILLINGS RESOURCE AREA, MILES CITY DISTRICT
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
COUNTY: CARBON
QUAD NAME: TOLLMAN FLAT QUAD CODE: 4510912
TOWNRANGE: 008S020E SECTION: 35 TRS COMMENTS: 26N2N2.23SW4
LATITUDE: 450533 LONGITUDE: 1091321 PHYSICAL PROVINCE: BH
WATERSHED: 10070006 ELEVATION: 6200 ACREAGE: 50
DIRECTIONS: TAKE HWY 308 FROM RED LODGE ABOUT 5 MILES TO JUST PAST STRIP
MINE. FOLLOW UNIMPROVED ROAD SOUTH OF HIGHWAY ABOUT 6 MILES
TO NORTH FORK OF GROVE CREEK.
HABITAT DESCRIPTION: LIMESTONE LITHOSOL AND TALUS; DOUGLAS FIR-LIMBER PINE
FELLFIELD, WITH ANTENNARIA, ERITICHIUM HOWARDII, SENECIO
CANUS, CYMOPTERUS TEREBINTHINUS.
ELEMENT DATA: EST. 51-100 PLANTS, IN 4 SMALL SPARSE SUBPOPULATIONS; SEED
DISPERSING; NO EVIDENCE OF DISTURBANCE.

BEST SOURCE: LESICA, P. 1986. FIELD SURVEY IN CARBON COUNTY OF 23-27
JUNE. VOUCHER-(3403) UM.
COMMENTS: ENTIRE AREA HAS NOT BEEN SEARCHED.

* * *

EOCODE: PDROS19040.003 SURVEY SITE: GROVE CREEK
NAME: PHYSOCARPUS MONOGYNUS GRANK: G4 SRANK: SU FEDERAL STATUS:
COMMON NAME: MOUNTAIN NINEBARK LAST OBSERVATION: 1986-06-24 PRECISION: SC
EORANK: B EORANK COMMENTS:
MANAGED AREAS: BLM: BILLINGS RESOURCE AREA, MILES CITY DISTRICT
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
COUNTY: CARBON
QUAD NAME: TOLMAN FLAT QUAD CODE: 4510912
TOWNRANGE: 008S020E SECTION: 26 TRS COMMENTS: E2,23,35;
LATITUDE: 450547 LONGITUDE: 1091312 PHYSICAL PROVINCE: BH
WATERSHED: 10070006 ELEVATION: 6500 ACREAGE: 500
DIRECTIONS: TAKE HWY 308 FORM RED LODGE ABOUT 5 MILES TO JUST PAST STRIP
MINE. FOLLOW UNIMPROVED ROAD SOUTH OF HIGHWAY ABOUT 6 MILES
TO NORTH FORK OF GROVE CREEK. TRSCOMM CONT.: T9SR20E:2NW4.
HABITAT DESCRIPTION: SHALLOW LIMESTONE SOIL: PSEUDOTSUGA MENZIESII-PINUS FLEXILIS
FELLFIELD AND FOREST, WITH POTENTILLA FRUTICOSA, PHYSOCARPUS
MALVACEUS.
ELEMENT DATA: EST. 1000-10,000 PLANTS IN 3 SUBPOPULATIONS; IN FLOWER AND
FRUIT; NO EVIDENCE OF DISTURBANCE.

BEST SOURCE: LESICA, P. 1986. FIELD SURVEY IN CARBON COUNTY OF 23-27
JUNE. (3894), 1986, SPECIMEN #104528 UM.
COMMENTS: FULL EXTENT OF EO UNKNOWN. BORDERS PHYSPROV MR.
ALSO LESICA, P. (3409), 1985, SPECIMEN #102328 UM.

Montana Natural Heritage Program

Element Occurrences: Vicinity of Phillips Petroleum Ruby A Federal 1-9, Carbon County, Montana

EOCODE: AMAFB06020.002 SURVEY SITE: WOLF CREEK-COLONY #2

NAME: CYNOMYS LEUCURUS GRANK: G4 SRANK: S2 FEDERAL STATUS:
COMMON NAME: WHITE-TAILED PRAIRIE DOG LAST OBSERVATION: 1977- PRECISION: M
EORANK: C EORANK COMMENTS:
MANAGED AREAS: PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
COUNTY: CARBON
QUAD NAME: HOLLENBECK DRAW QUAD CODE: 4510911
TOWNRANGE: 008S022E SECTION: 33 TRS COMMENTS:
LATITUDE: 450547 LONGITUDE: 1090208 PHYSICAL PROVINCE: BH
WATERSHED: 10070006 ELEVATION: 3910 ACREAGE: 2
DIRECTIONS: 3.4 MI. S. OF BELFRY HWY 397 ON W. SIDE HWY. SPECIFIC LOCATION NOT KNOWN.

HABITAT DESCRIPTION:

ELEMENT DATA: VIABILITY OF THIS POPULATION QUESTIONABLE - NO DIRECT CORRIDOR FOR IMMIGRATION

BEST SOURCE: FLATH, DENNIS. MT DEPT. FW&P, MSU CAMPUS, BOX 5, BOZEMAN, MT 59717. TEL: (406) 994-6354.
COMMENTS:

EOCODE: AMAFB06020.005 SURVEY SITE: ROBINSON DRAW-COLONY #5

NAME: CYNOMYS LEUCURUS GRANK: G4 SRANK: S2 FEDERAL STATUS:
COMMON NAME: WHITE-TAILED PRAIRIE DOG LAST OBSERVATION: 1977- PRECISION: M
EORANK: A EORANK COMMENTS: LARGEST KNOWN CONTIGUOUS COLONY IN MT
MANAGED AREAS: PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
CUSTER NATIONAL FOREST - BEARTOOTH RANGER DISTRICT
BLM: BILLINGS RESOURCE AREA, MILES CITY DISTRICT
COUNTY: CARBON
QUAD NAME: TOLMAN FLAT QUAD CODE: 4510912
TOWNRANGE: 009S020E SECTION: 26 TRS COMMENTS: 27
LATITUDE: 450053 LONGITUDE: 1091402 PHYSICAL PROVINCE: BH
WATERSHED: 10070006 ELEVATION: 5940 ACREAGE: 248
DIRECTIONS: GO TO CHANCE (8.5 MI. S. BELFRY). PROCEED WEST ON DIRT ROAD (GO N AT "T") AND TAKE 1ST LEFT. CONTINUE WEST APPROX. 7 MI. TO ROBINSON DRAW.
HABITAT DESCRIPTION: COLONY IN VICINITY OF ROBINSON DRAW. SMALL SPRING AND SEVERAL FEEDER STREAMS IN AREA.

ELEMENT DATA:

BEST SOURCE: FLATH, DENNIS. MT DEPT. FW&P, MSU CAMPUS, BOX 5, BOZEMAN, MT 59717. TEL: (406) 994-6354.
COMMENTS: 248 ACRES ON PRIVATE (176), BLM (24), FS (48). SITE WITHIN THE BLM MILES CITY DISTRICT OFFICE.

Montana Natural Heritage Program
Element Occurrences: Vicinity of Phillips Petroleum Ruby A Federal 1-9, Carbon County, Montana

EOCODE: AMAFB06020.004 SURVEY SITE: CHANCE-COLONY #4
NAME: CYNOMYS LEUCURUS GRANK: G4 SRANK: S2 FEDERAL STATUS:
COMMON NAME: WHITE-TAILED PRAIRIE DOG LAST OBSERVATION: 1977- PRECISION: M
EORANK: B EORANK COMMENTS:
MANAGED AREAS: PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
COUNTY: CARBON
QUAD NAME: HOLLENBECK DRAW QUAD CODE: 4510911
TOWNRANGE: 009S021E SECTION: 24 TRS COMMENTS:
LATITUDE: 450137 LONGITUDE: 1090507 PHYSICAL PROVINCE: BH
WATERSHED: 10070006 ELEVATION: 4050 ACREAGE: 19
DIRECTIONS: APPROX. 8.5 MI. S. OF BELFRY ON HWY 397. CROSS RIVER AND GO WEST ON ACCESS ROAD TO 'T' (1.2 MI.) COLONY IN VICINITY OF "T" IN ROAD.
HABITAT DESCRIPTION:

ELEMENT DATA: 19 ACRES ON PRIVATE LAND.

BEST SOURCE: FLATH, DENNIS. MT DEPT. FW&P, MSU CAMPUS, BOX 5, BOZEMAN, MT 59717. TEL: (406) 994-6354.
COMMENTS: EXACT SITE LOCATION UNKNOWN.

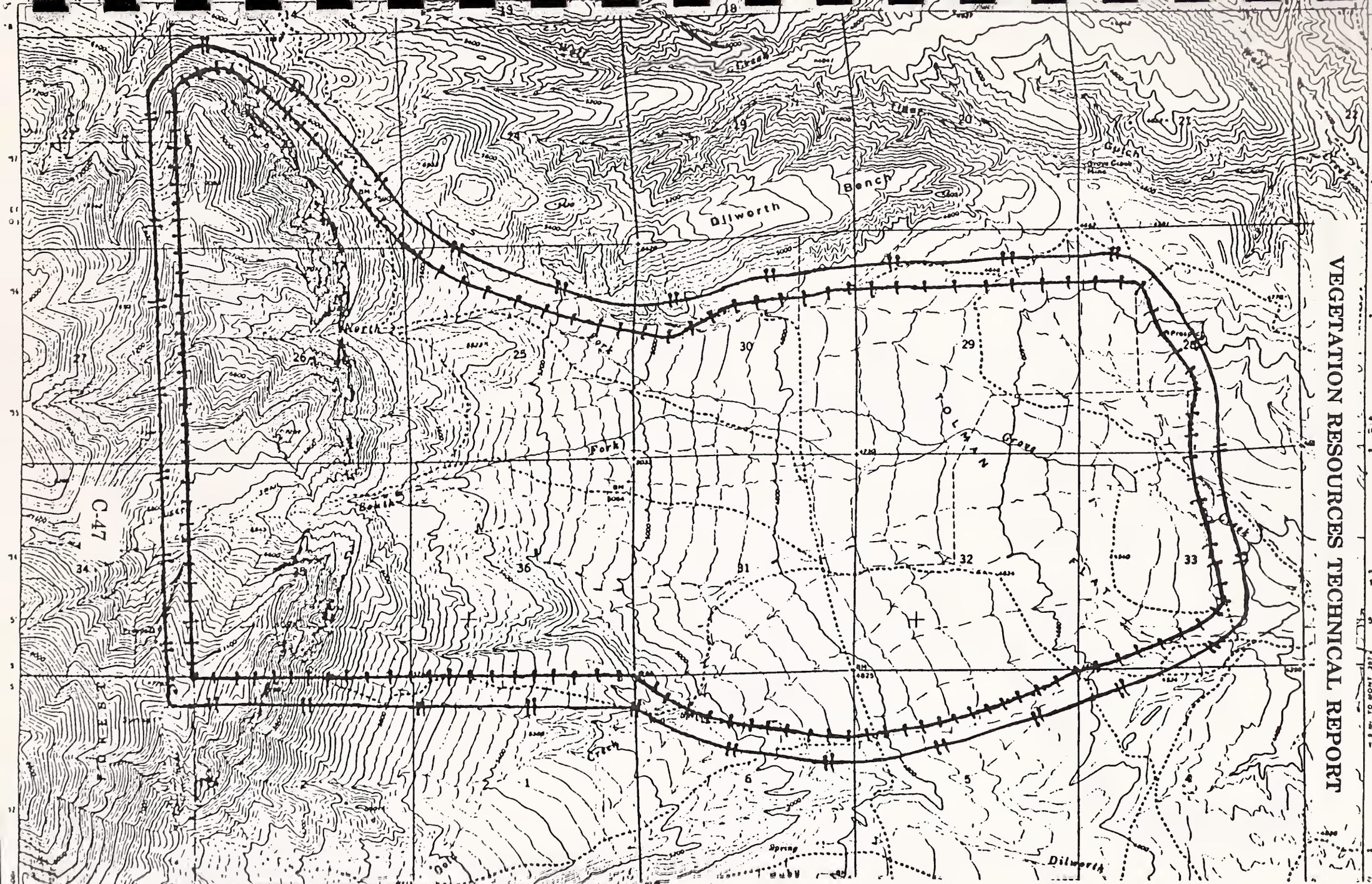
* * *

EOCODE: AMAFB06020.003 SURVEY SITE: HOLLENBECK-COLONY #3
NAME: CYNOMYS LEUCURUS GRANK: G4 SRANK: S2 FEDERAL STATUS:
COMMON NAME: WHITE-TAILED PRAIRIE DOG LAST OBSERVATION: 1977- PRECISION: M
EORANK: A EORANK COMMENTS:
MANAGED AREAS: PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
COUNTY: CARBON
QUAD NAME: HOLLENBECK DRAW QUAD CODE: 4510911
TOWNRANGE: 009S022E SECTION: 17 TRS COMMENTS: 16,20
LATITUDE: 450245 LONGITUDE: 1090335 PHYSICAL PROVINCE: BH
WATERSHED: 10070006 ELEVATION: 3960 ACREAGE: 85
DIRECTIONS: APPROX. 8.2 MI. S. OF BELFRY ON HWY 397; ACCESS ROAD TO WEST .4 MI. EO ON EITHER SIDE OF ACCESS ROAD?

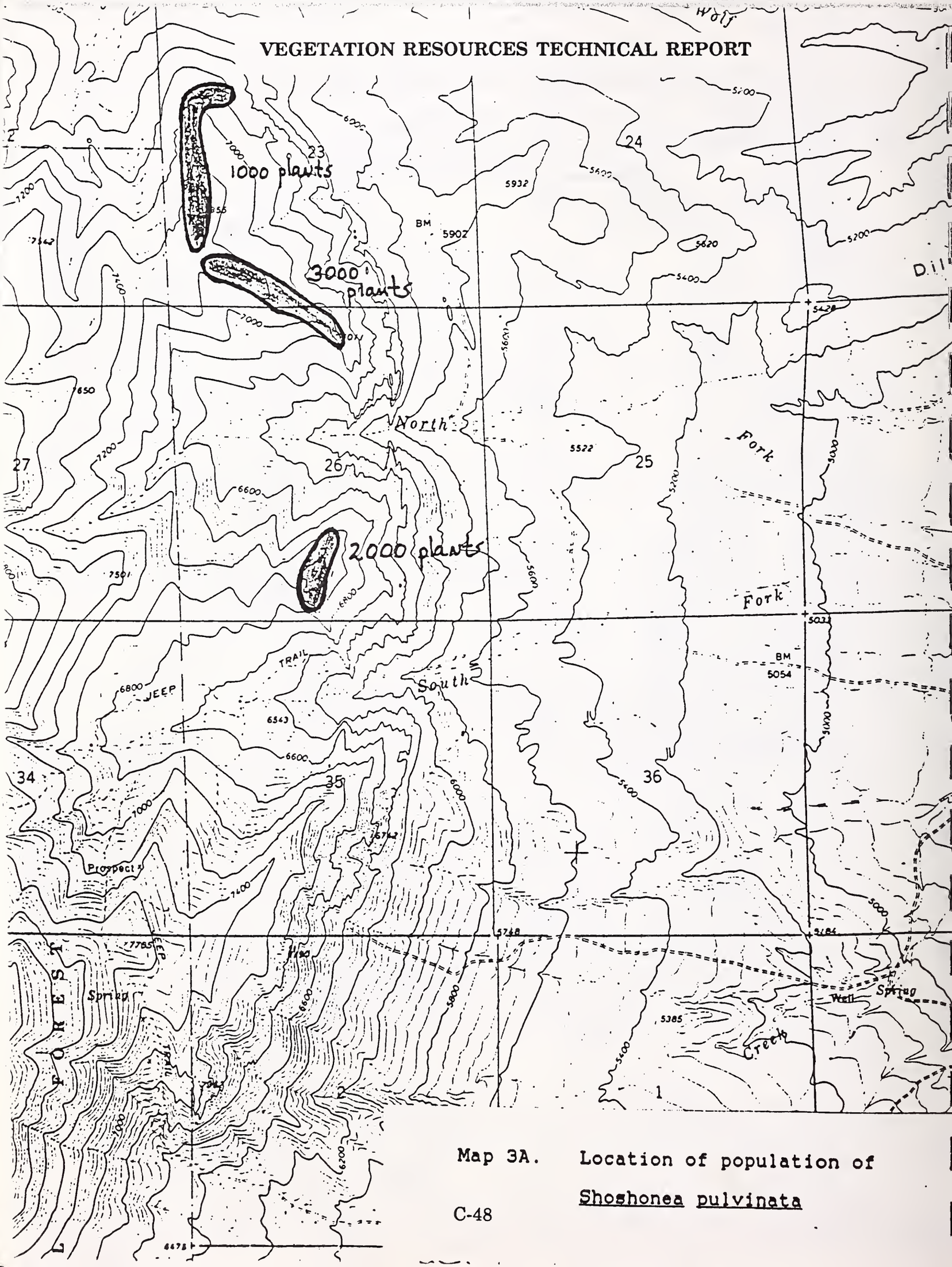
HABITAT DESCRIPTION: 75-85 ACRES ON PRIVATE LAND IN RIVER VALLEY.

ELEMENT DATA:

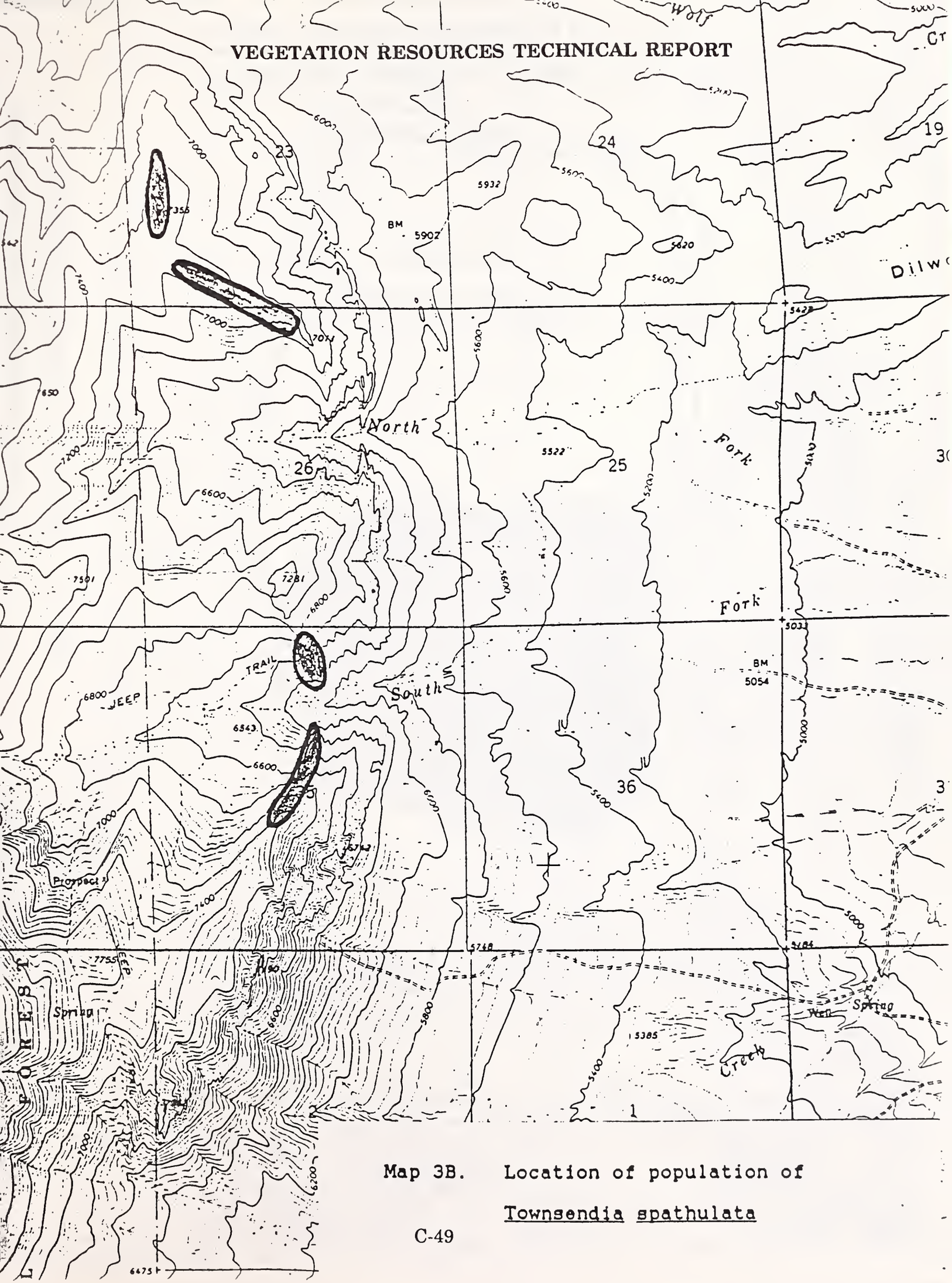
BEST SOURCE: FLATH, DENNIS. MT DEPT. FW&P, MSU CAMPUS, BOX 5, BOZEMAN, MT 59717. TEL: (406) 994-6354.
COMMENTS: SEC. 16 IS STATE OWNED; EAST HALF OF SEC. 20 IS BLM ADMINISTERED; WEST HALF IS PRIVATE.



Map 2. Ecological boundaries of proposed Meeteetse Spires Preserve.

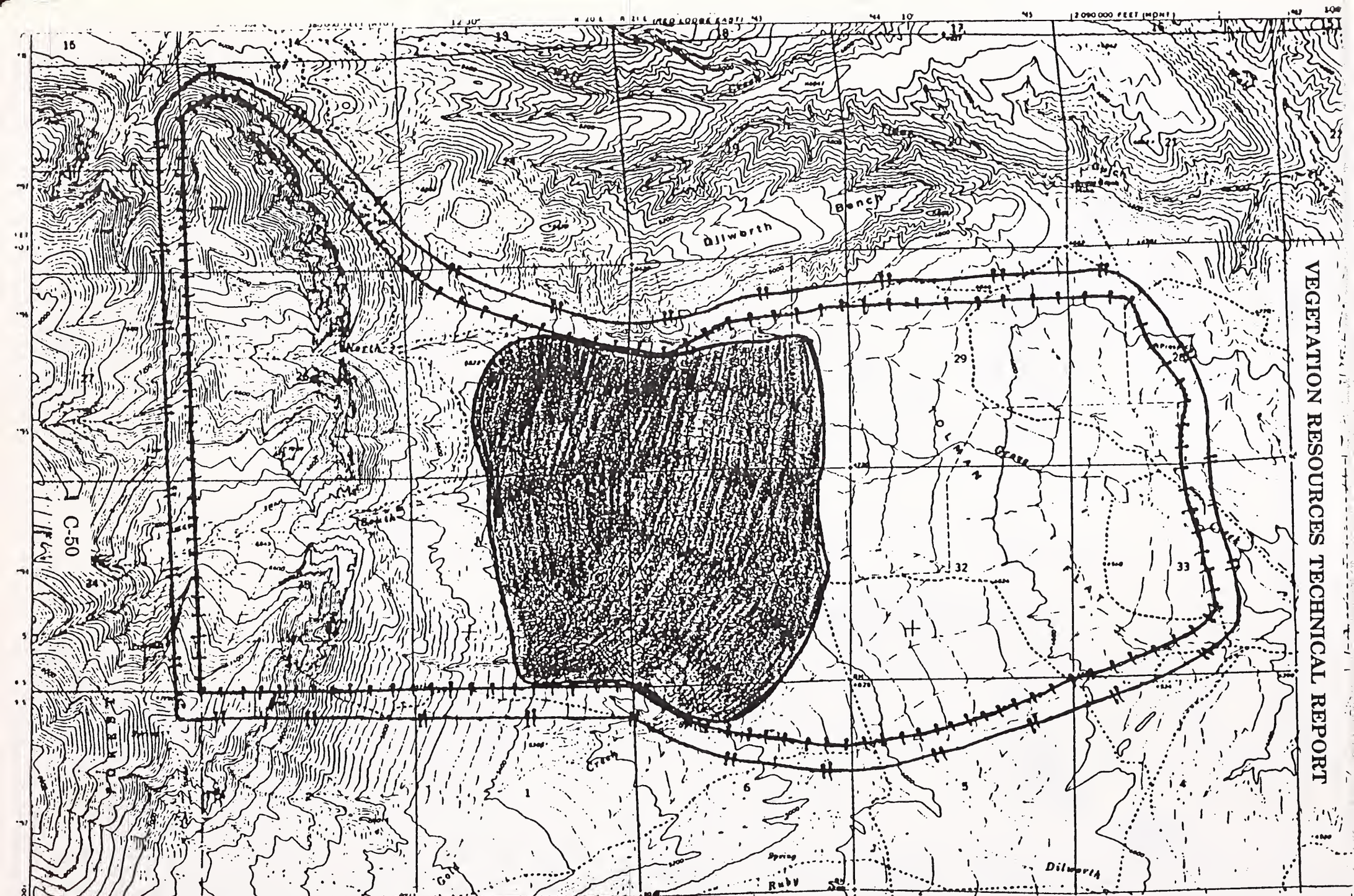


Map 3A. Location of population of Shoshonea pulvinata



Map 3B. Location of population of

Townsendia spathulata



Map 3C. Location of Artemisia arbuscula/
Agropyron spicatum Plant Association

APPENDIX B

Quantitative Data for the Ruby Creek and Gold Creek Proposed Drill Sites

RUBY CREEK DRILL SITE--POINT INTERCEPT METHOD

Purpose

The purpose of this study was to obtain site-specific data on the area that would be disturbed by the proposed Ruby A Federal No. 1-9 exploratory oil/gas drill site and access alternatives. On-site investigation identified all major vegetation cover types within the project area, and the predominant plant species within each vegetation type. Because major impacts would occur at the two alternative drill sites, quantitative measurements were taken using the point intercept method. Results obtained from the proposed Line Creek drill site location would provide pertinent information for the understory of all high elevation sagebrush understory vegetation; results from the Gold Creek drill site location characterize the general understory for the limber pine woodland habitat.

Method

The point intercept method for quantitative vegetation analysis is performed by running a straight line or several straight lines across the area to be sampled. Along each line are evenly spaced points at which the vegetation or cover type is to be sampled. A point is dropped perpendicular to the line, and the plant or cover type (bare, rock, litter) it touches is recorded. For this analysis, two 100-foot transects were run at each drill site. Points occurred at one-foot intervals for a total of 200 points sampled per site.

Results

Drill Site - Ruby Creek

Table CA-1 presents the raw data obtained for the two transects at the drill site location. One transect was run parallel to the contour of the slope while the second transect crossed the slope perpendicularly. These transects indicate that approximately 32 percent of the area is covered by grass, 32 percent by shrubs or sub-shrubs, 11 percent by forbs, 7 percent by moss and/or cryptogamic crust, 3 percent bare soil, 3 percent rock and 12 percent litter. Predominant grass species include sheep fescue, Idaho fescue, bluegrass, and prairie junegrass. Shrub species include big sagebrush, rabbitbrush, and common juniper. Forb species include lupine, yarrow, Hood's phlox, fleabane daisy, and cymopterus.

Drill Site - Gold Creek

Table CA-2 presents the raw data for the two transects run at the Gold Creek site. As in the previous site, one transect paralleled the contour while the other was perpendicular to it. The transects indicate that approximately 29 percent of the area is covered by grass, 41 percent by shrubs or sub-shrubs, 3 percent by forbs, 1 percent by moss and/or cryptogamic crust, 1 percent bare soil, 14 percent rock and 10 percent litter. Predominant graminoid species include sheep fescue, Idaho fescue, Canada wildrye, elk sedge, and prairie junegrass. Shrub species included big sagebrush, rabbitbrush, and common juniper. Forb species include lupine, yarrow, Hood's phlox, fleabane daisy, pussytoes, and cymopterus.

Table CA-1. Raw Point Intercept Data for the Alternative A (Ruby Creek) Drill Site.

Transect 1

1	KOPY	26	LITTER	51	LITTER	76	ASMI
2	FEOV	27	MOSS	52	FEOV	77	FEOV
3	CHRYS	28	ROCK	53	FEOV	78	FEOV
4	CHRYS	29	FEOV	54	ASMI	79	ASMI
5	BARE	30	ASMI	55	MOSS	80	ROCK
6	CYMOP	31	LITTER	56	ROCK	81	LITTER
7	FEOV	32	LITTER	57	KOPY	82	ARFR
8	ARTR	33	FEOV	58	ROCK	83	LUPINE
9	FEOV	34	ASGP	59	AGSP	84	LITTER
10	ROCK	35	LITTER	60	LITTER	85	ARFR
11	FEOV	36	FEOV	61	FEOV	86	MOSS
12	FEOV	37	MOSS	62	ROCK	87	FEOV
13	STIPA	38	ARTR	63	BARE	88	BARE
14	MOSS	39	ERIG	64	LITTER	89	LITTER
15	MOSS	40	MOSS	65	FEOV	90	FEOV
16	BARE	41	FEOV	66	AGSP	91	LUPINE
17	MOSS	42	PHLOX	67	LITTER	92	FEOV
18	BARE	43	ERIG	68	POTEN	93	MOSS
19	FEOV	44	MOSS	69	LITTER	94	KOPY
20	ERIG	45	KOPY	70	MOSS	95	ERIG
21	AGSP	46	FEOV	71	FEOV	96	FEOV
22	ASMI	47	ARFR	72	AGSP	97	FEOV
23	FEOV	48	ERIG	73	LITTER	98	FEOV
24	CYMOP	49	MOSS	74	MOSS	99	LITTER
25	FEOV	50	KOPY	75	ARFR	100	AGSP

Transect 2

1	ARTR	26	ARTR	51	ARTR	76	FEID
2	POA	27	ARTR	52	ARTR	77	ARTR
3	ARTR	28	ARTR	53	POA	78	ARTR
4	FEID	29	ARTR	54	JUCO	79	ARTR
5	FEID	30	POA	55	JUCO	80	ARTR
6	FEOV	31	POA	56	JUCO	81	ARTR
7	ARTR	32	KOPY	57	ARTR	82	ARTR
8	ARTR	33	POA	58	ARTR	83	LITTER
9	ARTR	34	FEID	59	ARTR	84	ARTR
10	ARTR	35	FEOV	60	ARTR	85	ARTR
11	ARTR	36	ARTR	61	ARTR	86	LITTER
12	ARTR	37	POA	62	FEOV	87	FEOV
13	ARTR	38	ARTR	63	KOPY	88	FEOV
14	ARTR	39	ACMI	64	ARTR	89	ARTR
15	ARTR	40	FEID	65	ARTR	90	ARTR
16	FEID	41	LITTER	66	ARTR	91	ARTR
17	ARTR	42	FEOV	67	ASMI	92	ARTR
18	ACMI	43	ARTR	68	FEOV	93	LITTER
19	LITTER	44	ARTR	69	LITTER	94	FEOV
20	LITTER	45	ARTR	70	LITTER	95	ASMI
21	ARTR	46	ARTR	71	MOSS	96	LITTER
22	ARTR	47	FEOV	72	FEOV	97	LITTER
23	ARTR	48	ARTR	73	ERIG	98	AGSP
24	ARTR	49	LUPINE	74	AGSP	99	ARTR
25	ARTR	50	ARTR	75	FEOV	100	ARTR

Table CA-2. Raw Point Intercept Data for the Alternative B (Gold Creek) Drill Site.

Transect 1

1	ROCK	26	ARTR	51	ROCK	76	ARTR
2	ARTR	27	ARTR	52	FEOV	77	ROCK
3	ELCA	28	LUPINE	53	LITTER	78	ROCK
4	ELCA	29	ANTEN	54	ARTR	79	FEOV
5	PSME	30	ASMI	55	ARTR	80	CAGE
6	ARTR	31	FEOV	56	ARTR	81	BARE
7	ARTR	32	ARTR	57	ARTR	82	AGSP
8	PHAL	33	AGSP	58	ARTR	83	ARTR
9	ELCA	34	LITTER	59	ARTR	84	JUHO
10	LITTER	35	ROCK	60	ARTR	85	JUHO
11	ELCA	36	FEOV	61	ARTR	86	JUHO
12	STIPA	37	FEOV	62	FEID	87	CAGE
13	LITTER	38	ARTR	63	FEID	88	FEOV
14	FEOV	39	PSME	64	GALIUM	89	FEID
15	FEOV	40	PSME	65	ROCK	90	LITTER
16	FEOV	41	ARTR	66	ROCK	91	ROCK
17	ARTR	42	ROCK	67	AGSP	92	ROCK
18	ARTR	43	ARTR	68	LITTER	93	ARTR
19	ARTR	44	ARTR	69	ROCK	94	BARE
20	LITTER	45	ARTR	70	ARTR	95	JUHO
21	ARTR	46	ARTR	71	ARTR	96	JUHO
22	ACMI	47	MOSS	72	LITTER	97	ARTR
23	LITTER	48	ROCK	73	FEOV	98	ARTR
24	FEOV	49	ARTR	74	CAGE	99	ARTR
25	FEOV	50	KOPY	75	AGSP	100	FEOV

Transect 2

1	ROCK	26	ARTR	51	AGSP	76	ARTR
2	ARTR	27	ARTR	52	STIPA	77	FEOV
3	ARTR	28	ARTR	53	LITTER	78	ERIG
4	ARTR	29	ARTR	54	KOPY	79	ARTR
5	STIPA	30	FEOV	55	FEOV	80	AGSP
6	ROCK	31	FEOV	56	LITTER	81	ROCK
7	ROCK	32	FEOV	57	KOPY	82	ROCK
8	AGSP	33	LUPINE	58	ARTR	83	ROCK
9	LITTER	34	ARTR	59	LITTER	84	LITTER
10	ARTR	35	ARTR	60	FEOV	85	ARTR
11	ARTR	36	ROCK	61	LUPINE	86	ARTR
12	ASMI	37	ARTR	62	ARTR	87	LITTER
13	FEID	38	ARTR	63	ARTR	88	LITTER
14	BARE	39	ARTR	64	KOPY	89	KOPY
15	FEOV	40	ARTR	65	ASMI	90	AGSP
16	ARTR	41	ARTR	66	ARTR	91	CAGE
17	ARTR	42	FEOV	67	ROCK	92	ARTR
18	ARTR	43	ARTR	68	ROCK	93	ARTR
19	MOSS	44	ARTR	69	PSME	94	ARTR
20	AGSP	45	ROCK	70	ARTR	95	ARTR
21	ARTR	46	FEID	71	ARTR	96	ARTR
22	ARTR	47	LITTER	72	LITTER	97	ELCA
23	FEOV	48	LUPINE	73	ARTR	98	ARTR
24	CAGE	49	LITTER	74	LITTER	99	ARTR
25	LITTER	50	ARTR	75	FEOV	100	LITTER

APPENDIX C

Montana Natural Heritage Program Data Files for Plant Species of Concern within a 15-mile Radius of the Proposed Project Area

Montana Natural Heritage Program
Summary of Element Occurrences in the Vicinity of Line Creek Plateau
(5-Mile Radius)

Name	Global Rank	State Rank	Federal Status	#EOs
DRABA FORSILDII	G?	S1		1
KOBRESIA MACROCARPA	G5	S1		1
KOENIGIA ISLANDICA	G4	S2		1
PEDICULARIS OEDERI	G?	S2		1
PHIPPSIA ALGIDA	G5	S1	3C	3
SALIX BARRATTIANA	G5	S1		1
SENECIO AMPLECTENS VAR HOLMII	G?	S1		1
SENECIO FUSCATUS	G4	S2		1

Total number species 8
Total # Element Occurrences 10

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau Vicinity (5-mile radius)

EOCODE: PDBRA11200.001 SITE NAME: BEARTOOTH HIGHWAY
NAME: DRABA PORSILDII GRANK: G? SRANK: S1 FEDERAL STATUS:
COMMON NAME: PORSILD'S DRABA LAST OBSERVATION: 1981-07-02 PRECISION: S
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 17 TRS COMMENTS: CENTER LATITUDE : 450235 LONGITUDE: 1092420
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 9000 ACREAGE: 0
DIRECTIONS: BEARTOOTH MOUNTAINS, SLOPE BETWEEN SWITCHBACKS OF HWY 212,
20 MILES FROM RED LODGE; JUST BELOW OVERLOOK.

HABITAT DESCRIPTION: STEEP NE-FACING SLOPE; GRANITIC PARENT MATERIAL; WITH DRABA
INCERTA AND SILENE ACAULIS.

ELEMENT DATA: COMMON.

BEST SOURCE: LESICA, PETER. DEPT. OF BOTANY, UNIVERSITY OF MONTANA,
MISSOULA, MT 59812.
COMMENTS: VOUCHER-LESICA, P. (1-88), 1981, MONTU (0928600), DET. BY
G.A. MULLIGAN, 8/88.

* * *

EOCODE: PMCYPOF060.001 SITE NAME: WYOMING CREEK HEADWATERS
NAME: KOBRESIA MACROCARPA GRANK: G5 SRANK: S1 FEDERAL STATUS:
COMMON NAME: KOBRESIA LAST OBSERVATION: 1980-08-12 PRECISION: S
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 33 TRS COMMENTS: NENW4 LATITUDE : 450019 LONGITUDE: 1092329
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 9800 ACREAGE: 50
DIRECTIONS: BEARTOOTH PLATEAU, NEAR BEARTOOTH PASS ALONG U.S. HWY. 212
AT MONTANA-WYOMING BORDER; ALONG A SMALL SIDE BRANCH (WEST)
OF WYOMING CREEK.
HABITAT DESCRIPTION: MOSSY BOG WITH SALIX RETICULATA AND SEDUM; DIVERSITY OF
ALPINE HABITATS.

ELEMENT DATA: UNKNOWN; JEEP TRAIL AND GRAVEL PIT NEARBY BUT NOT AFFECTING
SITE.

BEST SOURCE: DORN, R.D. BOX 1471, CHEYENNE, WY 82003. (3391). 1980.
SPECIMEN #830259 RM.
COMMENTS:

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau Vicinity (5-mile radius)

EOCODE: PDPGN0D010.001 SITE NAME:
NAME: KOENIGIA ISLANDICA GRANK: G4 SRANK: S2 FEDERAL STATUS:
COMMON NAME: ISLAND KOENIGIA LAST OBSERVATION: 1980-08-12 PRECISION: M
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510913
TOWNRANGE: 009S019E SECTION: 33 TRS COMMENTS: NW4 LATITUDE : 450020 LONGITUDE: 1092326
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 9800 ACREAGE: 0
DIRECTIONS: BEARTOOTH PLATEAU. IMMEDIATELY NORTH OF MT-WY LINE, ABOUT
0.8 MILES EAST OF HWY 12.

HABITAT DESCRIPTION: WET GRAVEL BARS BELOW SNOW BANKS. WITH PHIPPSIA, CERASTIUM.

ELEMENT DATA: UNKNOWN.

BEST SOURCE: DORN,R.D. (3387). 1980. SPECIMEN #329213 RM.

COMMENTS: NONE.

* * *

EOCODE: PDSCR1K0R0.001 SITE NAME:
NAME: PEDICULARIS OEDERI GRANK: G? SRANK: S2 FEDERAL STATUS:
COMMON NAME: OEDER'S LOUSEWORT LAST OBSERVATION: 1966-07-01 PRECISION: M
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 20 TRS COMMENTS: LATITUDE : 450115 LONGITUDE: 1092437
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 9720 ACREAGE: 0
DIRECTIONS: ALONG HIGHWAY 212, 25 MILES SOUTHWEST OF RED LODGE.

HABITAT DESCRIPTION: ON WET GRASSY BANKS ALONG A SMALL LAKE. IN ASSOCIATION WITH
VIOLA ADARICA, KALMEA POLIFOLIA AND SALIX PSEUDOLAPPONCERII.

ELEMENT DATA: FLOWERS YELLOWISH. FREQUENT.

BEST SOURCE: STOLZE, R.G. (1083). 1966. SPECIMEN #70796-5 RM.

COMMENTS: NONE.

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau Vicinity (5-mile radius)

EOCODE: PMPOA4T010.001 SITE NAME: WYOMING CREEK HEADWATERS
NAME: PHIPPSIA ALGIDA GRANK: G5 SRANK: S1 FEDERAL STATUS: 3C
COMMON NAME: ICE GRASS LAST OBSERVATION: 1980-08-12 PRECISION: S
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 33 TRS COMMENTS: N2NW4 LATITUDE : 450019 LONGITUDE: 1092329
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 9800 ACREAGE: 50
DIRECTIONS: BEARTOOTH PLATEAU, HEADWATERS OF WYOMING CREEK, ALONG MONTANA-WYOMING BORDER, NEAR SOUTH END OF LINE CREEK PLATEAU.
HABITAT DESCRIPTION: WET GRAVEL BARS BELOW SNOW BANKS, WITH KOENIGIA AND CERASTIUM; DIVERSITY OF ALPINE HABITATS.

ELEMENT DATA: UNKNOWN; JEEP TRAIL AND GRAVEL PIT NEARBY BUT NOT AFFECTING SITE.

BEST SOURCE: DORN, R.D. BOX 1471, CHEYENNE, WY 82003. (3586). 1980. SPECIMEN #329216 RM.
COMMENTS:

* * *

EOCODE: PMPOA4T010.002 SITE NAME: LINE CREEK PLATEAU
NAME: PHIPPSIA ALGIDA GRANK: G5 SRANK: S1 FEDERAL STATUS: 3C
COMMON NAME: ICE GRASS LAST OBSERVATION: 1980-08-12 PRECISION: M
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: MOUNT MAURICE (15) QUAD CODE: 4510913
TOWNRANGE: 009S019E SECTION: 23 TRS COMMENTS: LATITUDE : 450139 LONGITUDE: 1092048
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 9840 ACREAGE: 0
DIRECTIONS: BEARTOOTH MOUNTAINS; LINE CREEK PLATEAU.

HABITAT DESCRIPTION: WET GRAVEL BARS BELOW SNOW BANK.

ELEMENT DATA: UNKNOWN.

BEST SOURCE: LACKSCHEWITZ, K.H., P. LESICA, J. PIERCE, J.K. CORY, & D. RAMSDEN. 1984. NOTEWORTHY COLLECTIONS-MT. MADRONO 31:254-257
COMMENTS: VOUCHER - DORN (3586). 1980. MONT.

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau Vicinity (5-mile radius)

EOCODE: PMPOA4T010.003 SITE NAME: SILVER RUN PLATEAU
NAME: PHIPPSIA ALGIDA GRANK: G5 SRANK: S1 FEDERAL STATUS: SC
COMMON NAME: ICE GRASS LAST OBSERVATION: 1981-08-14 PRECISION: M
EORANK: EORANK COMMENTS:
MANAGED AREAS: PPSWABEARINTUS NOT FOUND.
CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 008S019E SECTION: 23 TRS COMMENTS: LATITUDE : 450657 LONGITUDE: 1092321
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 10660 ACREAGE: 0
DIRECTIONS: SILVER RUN PLATEAU; BEARTOOTH MOUNTAINS.

HABITAT DESCRIPTION: WET GRAVEL ON GENTLY SLOPE.

ELEMENT DATA: UNKNOWN.

BEST SOURCE: LACKSCHEWITZ, K.H., P. LESICA, J. PIERCE, J.K. CORY, & D.
RAMSIEN. 1984. NOTEWORTHY COLLECTIONS-MT. MADRONO 31:254-257
COMMENTS: VOUCHER - LESICA, P. (1767). 1981. MONTU, MONT, COLO.

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EOCODE: PDSAL02ODO.001 SITE NAME: WYOMING CREEK HEADWATERS
NAME: SALIX BARRATTIANA GRANK: G5 SRANK: S1 FEDERAL STATUS:
COMMON NAME: BARRATT'S WILLOW LAST OBSERVATION: 1972-07-31 PRECISION: S
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 33 TRS COMMENTS: N2NW4 LATITUDE : 450019 LONGITUDE: 1093359
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 10000 ACREAGE: 50
DIRECTIONS: BEARTOOTH PLATEAU. HEADWATERS OF WYOMING CREEK, ALONG
MONTANA-WYOMING BORDER, NEAR SOUTH END OF LINE CREEK
PLATEAU.
HABITAT DESCRIPTION: ALPINE MEADOW WITH SALIX GLAUCA, S. WOLFII, S. PLANIFOLIA;
DIVERSITY OF ALPINE HABITATS.

ELEMENT DATA: SHRUB 5 DM HIGH; JEEP TRAIL AND GRAVEL PIT NEARBY BUT NOT
AFFECTING SITE.

BEST SOURCE: DORN, R.D. BOX 1471, CHEYENNE, WY 82003. (1743). 1972.
SPECIMEN HERBARIUM.
COMMENTS:

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau Vicinity (5-mile radius)

EOCODE: PDASTSH022.001 SITE NAME:
NAME: SENECIO AMPLECTENS VAR HOLMII GRANK: G? SRANK: S1 FEDERAL STATUS:
COMMON NAME: CLASPING GROUNDSEL LAST OBSERVATION: 1955-08-04 PRECISION: M
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 19 TRS COMMENTS: LATITUDE : 450148 LONGITUDE: 1092550
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 7680 ACREAGE: 0
DIRECTIONS: RIM OF BEARTOOTH MOUNTAINS, JUST WEST OF QUAD CREEK; 23 MILES SOUTHWEST OF RED LODGE.

HABITAT DESCRIPTION: IN COARSE GRANITIC-SCHISTOID, WEST-FACING, RELATIVELY STABLE TALUS.

ELEMENT DATA: PLANTS FIBROUS-ROOTED WITH STOUT SHORTLY-BRANCHED CAUDEX. HEADS YELLOW, 1-2.

BEST SOURCE: CRONQUIST (6059). 1955. SPECIMEN #248436 RM.

COMMENTS: NONE.

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EOCODE: PDASTSH1E0.001 SITE NAME:
NAME: SENECIO FUSCATUS GRANK: G4 SRANK: S2 FEDERAL STATUS:
COMMON NAME: TWICE-HAIRY BUTTERWEED LAST OBSERVATION: 1978-07-26 PRECISION: M
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 32 TRS COMMENTS: N2 LATITUDE : 450020 LONGITUDE: 1092410
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 10200 ACREAGE: 0
DIRECTIONS: BEARTOOTH HIGHWAY AT WYOMING LINE.

HABITAT DESCRIPTION: ALPINE MEADOW WITH POLYGONUM, TRIFOLIUM. GENTLE, OPEN, GRANITIC SLOPES.

ELEMENT DATA: RAYS ORANGE-YELLOW.

BEST SOURCE: DORN,R.D. (3167). 1978. SPECIMEN #310311 RM.

COMMENTS: ALSO COLLECTED BY CRONQUIST (7996). 1955. SPECIMEN #248836 RM.

Montana Natural Heritage Program
Summary of Element Occurrences in the Vicinity of Line Creek Plateau
(10-Mile Radius)

Name	Global Rank	State Rank	Federal Status	#EOs
ARTEMISIA PEDATIFIDA	G3G4	S2		1
DRABA PORSILDII	G?	S1		2
ERIGERON FORMOSISSIMUS	G?	SU		1
HYMENOXYS TORREYANA	G?	S1		1
KOBRESIA MACROCARPA	G5	S1		1
KOENIGIA ISLANDICA	G4	S2		1
PAPAVER KLUANENSIS	G?	S1		2
PEDICULARIS OEDERI	G?	S2		1
PHIPPSIA ALGIDA	G5	S1	3C	3
PHYSOCARPUS MONOGYNUS	G4	SU		1
SALIX BARRATTIANA	G5	S1		1
SAXIFRAGA CHRYSANTHA	G?	S1		1
SENECIO AMPLECTENS VAR HOLMII	G?	S1		1
SENECIO FUSCATUS	G4	S2		1
SHOSHONEA PULVINATA	G3	S1	C2	1
TOWNSENDIA SPATHULATA	G3	S2	3C	1

Total number species 16
Total # Element Occurrences 20

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau (10-mile radius)

EOCODE: PDASTOS1A0.001 SITE NAME:
NAME: ARTEMISIA PEDATIFIDA GRANK: G3G4 SRANK: S2 FEDERAL STATUS:
COMMON NAME: BIRD'S-FOOT SAGEBRUSH LAST OBSERVATION: 1893-08-04 PRECISION: G
EORANK: EORANK COMMENTS:
MANAGED AREAS: PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
COUNTY: CARBON
QUAD NAME: RED LODGE EAST QUAD CODE: 4510922
TOWNRANGE: 007S020E SECTION: 26 TRS COMMENTS: LATITUDE : 451120 LONGITUDE: 1091410
WATERSHED: 10070006 PHYSICAL PROVINCE: MB ELEVATION: 5760 ACREAGE: 0
DIRECTIONS: NEAR REDLODGE.

HABITAT DESCRIPTION: UNKNOWN.

ELEMENT DATA: UNKNOWN.

BEST SOURCE: ROSE, J.N. (127). 1893. SPECIMEN #68745 RM.

COMMENTS: NONE.

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EOCODE: PDBRA11200.001 SITE NAME: BEARTOOTH HIGHWAY
NAME: DRABA PORSILDII GRANK: G? SRANK: S1 FEDERAL STATUS:
COMMON NAME: PORSILD'S DRABA LAST OBSERVATION: 1931-07-02 PRECISION: S
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 17 TRS COMMENTS: CENTER LATITUDE : 450835 LONGITUDE: 1092420
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 9000 ACREAGE: 0
DIRECTIONS: BEARTOOTH MOUNTAINS, SLOPE BETWEEN SWITCHBACKS OF HWY 212,
20 MILES FROM RED LODGE; JUST BELOW OVERLOOK.

HABITAT DESCRIPTION: STEEP NE-FACING SLOPE; GRANITIC PARENT MATERIAL; WITH DRABA INCERTA AND SILENE ACAULIS.

ELEMENT DATA: COMMON.

BEST SOURCE: LESICA, PETER. DEPT. OF BOTANY, UNIVERSITY OF MONTANA, MISSOULA, MT 59812.
COMMENTS: VOUCHER-LESICA, P. (1496), 1981, MONTU (092800), DET. BY G.A. MULLIGAN, 2/82.

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau (10-mile radius)

EOCODE: PDBRA11200.002 SITE NAME: SILVER RUN PEAK
NAME: DRABA PORSILDII GRANK: G? SRANK: S1 FEDERAL STATUS:
COMMON NAME: PORSILD'S DRABA LAST OBSERVATION: 1981-08-15 PRECISION: S
EORANK: EORANK COMMENTS:
MANAGED AREAS: ABSAROKA-BEARTOOTH WILDERNESS AREA
CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: ALPINE (15) QUAD CODE: 4510915
TOWNRANGE: 008S01SE SECTION: 20 TRS COMMENTS: N2 LATITUDE : 450704 LONGITUDE: 1093157
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 11800 ACREAGE: 0
DIRECTIONS: BEARTOOTH MOUNTAINS, RIDGE 1 KM EAST OF SILVER RUN PEAK.

HABITAT DESCRIPTION: GRAVELLY SOIL AROUND ROCKS ON RIDGE; GRANITIC PARENT MATERIAL; WITH GEUM ROSSII AND TRIFOLIUM NANUM.

ELEMENT DATA: COMMON.

BEST SOURCE: LESICA, PETER. DEPT. OF BOTANY, UNIVERSITY OF MONTANA, MISSOULA, MT 59812.
COMMENTS: VOUCHER-LESICA, P. (1786), 1981, MONTU (092813), DET. BY G.A. MULLIGAN, 2/82.

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EOCODE: PD4STSM1K0.003 SITE NAME: RED LODGE
NAME: ERIGERON FORMOSISSIMUS GRANK: G? SRANK: SU FEDERAL STATUS:
COMMON NAME: LAST OBSERVATION: 1919-07-22 PRECISION: S
EORANK: EORANK COMMENTS:
MANAGED AREAS: PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
COUNTY: CARBON
QUAD NAME: RED LODGE EAST QUAD CODE: 4510922
TOWNRANGE: 007S020E SECTION: 26 TRS COMMENTS: LATITUDE : 451120 LONGITUDE: 1091410
WATERSHED: 10070006 PHYSICAL PROVINCE: MB ELEVATION: 5760 ACREAGE: 0
DIRECTIONS: RED LODGE.

HABITAT DESCRIPTION: UNKNOWN.

ELEMENT DATA: IN FLOWER.

BEST SOURCE: HAWKINS, P.H. 1919. MT.

COMMENTS: NONE.

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau (10-mile radius)

EOCODE: PDAST530M0.002 SITE NAME: GROVE CREEK
NAME: HYMENOXYS TORREYANA GRANK: G? SRANK: S1 FEDERAL STATUS:
COMMON NAME: TORREY BITTERWEED LAST OBSERVATION: 1986-06-24 PRECISION: SC
EORANK: B EORANK COMMENTS: SMALL POPULATION, BUT HABITAT UNDISTURBED.
MANAGED AREAS: PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
COUNTY: CARBON
QUAD NAME: TOLMAN FLAT QUAD CODE: 4510912
TOWNRANGE: 008S020E SECTION: 23 TRS COMMENTS: W2W2 LATITUDE : 450702 LONGITUDE: 1091402
WATERSHED: 10070006 PHYSICAL PROVINCE: BH ELEVATION: 7100 ACREAGE: 15
DIRECTIONS: TAKE HWY 308 FROM RED LODGE ABOUT 5 MILES TO JUST PAST STRIP MINE. FOLLOW UNIMPROVED ROAD SOUTH OF HIGHWAY ABOUT 6 MILES TO NORTH FORK OF GROVE CREEK.
HABITAT DESCRIPTION: LIMESTONE LITHOSOL; PSEUDOTSUGA MENTZEISII/PINUS FLEXILIS FELLFIELD, WITH SHOSHONEA FULVINATA, ERITRICHIUM HOWARDII, POTENTILLA FRUTICOSA.
ELEMENT DATA: 101-1000 PLANTS; IN FLOWER AND IMMATURE FRUIT; NO EVIDENCE OF DISTURBANCE.

BEST SOURCE: LESICA, PETER. DEPT. OF BOTANY, UNIV. OF MONTANA, MISSOULA, MT 59812.
COMMENTS: VOUCHER-LESICA, P. (3895). 1986. UM. BORDERS PHYSPROV MR.

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EOCODE: PMCYP0F020.001 SITE NAME: WYOMING CREEK HEADWATERS
NAME: KOBRESIA MACROCARPA GRANK: G5 SRANK: S1 FEDERAL STATUS:
COMMON NAME: KOBRESIA LAST OBSERVATION: 1980-06-12 PRECISION: S
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 33 TRS COMMENTS: N2NW4 LATITUDE : 450019 LONGITUDE: 1092329
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 9800 ACREAGE: 50
DIRECTIONS: BEARTOOTH PLATEAU, NEAR BEARTOOTH PASS ALONG U.S. HWY. 212 AT MONTANA-WYOMING BORDER; ALONG A SMALL SIDE BRANCH (WEST) OF WYOMING CREEK.
HABITAT DESCRIPTION: MOSSY BOG WITH SALIX RETICULATA AND SEDUM; DIVERSITY OF ALPINE HABITATS.

ELEMENT DATA: UNKNOWN; JEEP TRAIL AND GRAVEL PIT NEARBY BUT NOT AFFECTING SITE.

BEST SOURCE: DORN, R.D. BOX 1471, CHEYENNE, WY 82003. (3591). 1980. SPECIMEN #330259 RM.
COMMENTS:

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau (10-mile radius)

EOCODE: PDPGN0D010.001 SITE NAME:
NAME: KOENIGIA ISLANDICA GRANK: G4 SRANK: S2 FEDERAL STATUS:
COMMON NAME: ISLAND KOENIGIA LAST OBSERVATION: 1980-08-18 PRECISION: M
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510913
TOWNRANGE: 009S019E SECTION: 33 TRS COMMENTS: NW4 LATITUDE : 450020 LONGITUDE: 1092326
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 9800 ACREAGE: 0
DIRECTIONS: BEARTOOTH PLATEAU. IMMEDIATELY NORTH OF MT-WY LINE, ABOUT
0.8 MILES EAST OF HWY 12.

HABITAT DESCRIPTION: WET GRAVEL BARS BELOW SNOW BANKS. WITH PHIPPSIA, CERASTIUM.

ELEMENT DATA: UNKNOWN.

BEST SOURCE: DORN,R.D. (3587). 1980. SPECIMEN #329215 RM.

COMMENTS: NONE.

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EOCODE: PDPAP0H0H0.001 SITE NAME: SILVER RUN PEAK
NAME: PAPAVER KLUANENSIS GRANK: G? SRANK: S1 FEDERAL STATUS:
COMMON NAME: ALPINE POPPY LAST OBSERVATION: 1951-08-15 PRECISION: S
EORANK: EORANK COMMENTS:
MANAGED AREAS: ABSAROKA-BEARTOOTH WILDERNESS AREA
CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: ALPINE (15) QUAD CODE: 4510915
TOWNRANGE: 008S018E SECTION: 20 TRS COMMENTS: N2 LATITUDE : 450704 LONGITUDE: 1093157
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 11700 ACREAGE: 0
DIRECTIONS: BEARTOOTH MOUNTAINS, 1 KM EAST OF SILVER RUN PEAK.

HABITAT DESCRIPTION: UNKNOWN.

ELEMENT DATA: UNKNOWN.

BEST SOURCE: LESICA, PETER. 1983. NOTEWORTHY COLLECTIONS - MONTANA.
MADRONO 30: 196.
COMMENTS: VOUCHER-LESICA, P. (1784), 1981, MONTU, MONT, WTU.

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau (10-mile radius)

EOCODE: PDPAPOH0H0.002 SITE NAME: SUNDANCE PASS
NAME: PAPAVER KLUANENSIS GRANK: G? SRANK: S1 FEDERAL STATUS:
COMMON NAME: ALPINE POPPY LAST OBSERVATION: 1981-08-15 PRECISION: S
EORANK: EORANK COMMENTS:
MANAGED AREAS: ABSAROKA-BEARTOOTH WILDERNESS AREA
CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: ALPINE (15) QUAD CODE: 4510915
TOWNRANGE: 008S017E SECTION: 25 TRS COMMENTS: NE4 LATITUDE : 450613 LONGITUDE: 1093405
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 11000 ACREAGE: 0
DIRECTIONS: BEARTOOTH MOUNTAINS, SUNDANCE PASS.

HABITAT DESCRIPTION: UNKNOWN.

ELEMENT DATA: UNKNOWN.

BEST SOURCE: LESICA, P. 1983. NOTEWORTHY COLLECTIONS - MONTANA.
MADROND 30: 196.
COMMENTS: VOUCHER-LESICA, P. (1791), 1981, MONTU, NY, CO.

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EOCODE: PDSCRIK0R0.001 SITE NAME:
NAME: PEDICULARIS OEDERI GRANK: G? SRANK: S2 FEDERAL STATUS:
COMMON NAME: OEDER'S LOUSEWORT LAST OBSERVATION: 1966-07-01 PRECISION: M
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 30 TRS COMMENTS: LATITUDE : 450115 LONGITUDE: 1093427
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 9920 ACREAGE: 0
DIRECTIONS: ALONG HIGHWAY 212, 25 MILES SOUTHWEST OF RED LODGE.

HABITAT DESCRIPTION: ON WET GRASSY BANKS ALONG A SMALL LAKE. IN ASSOCIATION WITH
VIOLA ADARICA, KALMEA POLIFOLIA AND SALIX PSEUDOLAPPONCERII.

ELEMENT DATA: FLOWERS YELLOWISH. FREQUENT.

BEST SOURCE: STOLZE, R.G. (1025). 1966. SPECIMEN #70796-5 RM.

COMMENTS: NONE.

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau (10-mile radius)

EOCODE: PMPOA4T010.001 SITE NAME: WYOMING CREEK HEADWATERS
NAME: PHIPPSIA ALGIDA GRANK: G5 SRANK: S1 FEDERAL STATUS: 3C
COMMON NAME: ICE GRASS LAST OBSERVATION: 1980-08-12 PRECISION: S
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 33 TRS COMMENTS: N2NW4 LATITUDE : 450019 LONGITUDE: 1092329
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 9800 ACREAGE: 50
DIRECTIONS: BEARTOOTH PLATEAU, HEADWATERS OF WYOMING CREEK, ALONG MONTANA-WYOMING BORDER, NEAR SOUTH END OF LINE CREEK PLATEAU.
HABITAT DESCRIPTION: WET GRAVEL BARS BELOW SNOW BANKS, WITH KOENIGIA AND CERASTIUM; DIVERSITY OF ALPINE HABITATS.

ELEMENT DATA: UNKNOWN; JEEP TRAIL AND GRAVEL PIT NEARBY BUT NOT AFFECTING SITE.

BEST SOURCE: DORN, R.D. BOX 1471, CHEYENNE, WY 82003. (3586). 1980. SPECIMEN #329216 RM.
COMMENTS:

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EOCODE: PMPOA4T010.002 SITE NAME: LINE CREEK PLATEAU
NAME: PHIPPSIA ALGIDA GRANK: G5 SRANK: S1 FEDERAL STATUS: 3C
COMMON NAME: ICE GRASS LAST OBSERVATION: 1980-08-12 PRECISION: M
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: MOUNT MAURICE (15) QUAD CODE: 4510913
TOWNRANGE: 009S019E SECTION: 23 TRS COMMENTS: LATITUDE : 450139 LONGITUDE: 1092048
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 9840 ACREAGE: 0
DIRECTIONS: BEARTOOTH MOUNTAINS; LINE CREEK PLATEAU.

HABITAT DESCRIPTION: WET GRAVEL BARS BELOW SNOW BANK.

ELEMENT DATA: UNKNOWN.

BEST SOURCE: LACKSCHEWITZ, K.H., P. LESICA, J. PIERCE, J.K. CORY, & D. RAMSDEN. 1984. NOTEWORTHY COLLECTIONS-MT. MADRONO 31:253-257
COMMENTS: VOUCHER - DORN (3586). 1980. MONT.

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau (10-mile radius)

EOCODE: PMPOA4T010.003 SITE NAME: SILVER RUN PLATEAU
NAME: PHIPPSIA ALGIDA GRANK: G5 SRANK: S1 FEDERAL STATUS: SC
COMMON NAME: ICE GRASS LAST OBSERVATION: 1981-08-14 PRECISION: M
EORANK: EORANK COMMENTS:
MANAGED AREAS: FFSWABEAR1MTUS NOT FOUND.
CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 008S01SE SECTION: 23 TRS COMMENTS: LATITUDE : 450657 LONGITUDE: 1093821
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 10660 ACREAGE: 0
DIRECTIONS: SILVER RUN PLATEAU; BEARTOOTH MOUNTAINS.

HABITAT DESCRIPTION: WET GRAVEL ON GENTLY SLOPE.

ELEMENT DATA: UNKNOWN.

BEST SOURCE: LACKSCHEWITZ, K.H., P. LESICA, J. PIERCE, J.K. CORY, & D.
RAMSDEN. 1984. NOTEWORTHY COLLECTIONS-MT. MADRONO 31:254-257
COMMENTS: VOUCHER - LESICA, P. (1767). 1981. MONTU, MONT, COLO.

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EOCODE: FDROS19040.003 SITE NAME: GROVE CREEK
NAME: PHYSOCARPUS MONOGYNUS GRANK: G4 SRANK: SU FEDERAL STATUS:
COMMON NAME: MOUNTAIN NINEBARK LAST OBSERVATION: 1986-06-24 PRECISION: SC
EORANK: B EORANK COMMENTS:
MANAGED AREAS: BILLINGS RESOURCE AREA
BLM MILES CITY DISTRICT OFFICE
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
COUNTY: CARBON
QUAD NAME: TOLMAN FLAT QUAD CODE: 4510912
TOWNRANGE: 008S020E SECTION: 26 TRS COMMENTS: E2,23,35; LATITUDE : 450547 LONGITUDE: 1091312
WATERSHED: 10070006 PHYSICAL PROVINCE: BH ELEVATION: 6500 ACREAGE: 500
DIRECTIONS: TAKE HWY 308 FORM RED LODGE ABOUT 5 MILES TO JUST PAST STRIP
MINE. FOLLOW UNIMPROVED ROAD SOUTH OF HIGHWAY ABOUT 6 MILES
TO NORTH FORK OF GROVE CREEK. TRSCOMM CONT.: T9SR20E:2NW4.
HABITAT DESCRIPTION: SHALLOW LIMESTONE SOIL; PSEUDOTSUGA MENZIESII-PINUS FLEXILIS
FELLFIELD AND FOREST, WITH POTENTILLA FRUTICOSA, PHYSOCARPUS
MALVACEUS.
ELEMENT DATA: EST. 1000-10,000 PLANTS IN 3 SUBPOPULATIONS; IN FLOWER AND
FRUIT; NO EVIDENCE OF DISTURBANCE.

BEST SOURCE: LESICA, P. 1986. FIELD SURVEY IN CARBON COUNTY OF 23-27
JUNE. (3894), 1986, SPECIMEN #104528 UM.
COMMENTS: FULL EXTENT OF EO UNKNOWN. BORDERS PHYSPROV MR.
ALSO LESICA, P. (3409), 1985, SPECIMEN #102328 UM.

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau (10-mile radius)

EOCODE: PDSAL020D0.001 SITE NAME: WYOMING CREEK HEADWATERS
NAME: SALIX BARRATTIANA GRANK: G5 SRANK: S1 FEDERAL STATUS:
COMMON NAME: BARRATT'S WILLOW LAST OBSERVATION: 1972-07-31 PRECISION: S
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 33 TRS COMMENTS: N2NW4 LATITUDE : 450019 LONGITUDE: 1092329
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 10000 ACREAGE: 50
DIRECTIONS: BEARTOOTH PLATEAU, HEADWATERS OF WYOMING CREEK, ALONG
MONTANA-WYOMING BORDER, NEAR SOUTH END OF LINE CREEK
PLATEAU.
HABITAT DESCRIPTION: ALPINE MEADOW WITH SALIX GLAUCA, S. WOLFII, S. PLANIFOLIA;
DIVERSITY OF ALPINE HABITATS.

ELEMENT DATA: SHRUB 5 DM HIGH; JEEP TRAIL AND GRAVEL PIT NEARBY BUT NOT
AFFECTING SITE.

BEST SOURCE: DORN, R.D. BOX 1471, CHEYENNE, WY 82003. (1743). 1972.
SPECIMEN #290820 RM.
COMMENTS:

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EOCODE: PDSAX0U0D0.001 SITE NAME: SILVER RUN PLATEAU
NAME: SAXIFRAGA CHRYSANTHA GRANK: G? SRANK: S1 FEDERAL STATUS:
COMMON NAME: GOLDEN SAXIFRAGE LAST OBSERVATION: 1981-08-15 PRECISION: M
EORANK: EORANK COMMENTS:
MANAGED AREAS: ABSAROKA-BEARTOOTH WILDERNESS AREA
CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: ALPINE (15) QUAD CODE: 4510915
TOWNRANGE: 008S016E SECTION: 20 TRS COMMENTS: LATITUDE : 450650 LONGITUDE: 1093604
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 11360 ACREAGE: 0
DIRECTIONS: BEARTOOTH MOUNTAINS, 1 KM SOUTHEAST OF SILVER RUN PEAK.

HABITAT DESCRIPTION: TUNDRA ON SOUTH-FACING SLOPE.

ELEMENT DATA: UNKNOWN.

BEST SOURCE: LACKSCHEWITZ, K.H., P. LESICA, J. PIERCE, J.K. CORY, & D.
RAMSDEN. 1984. NOTEWORTHY COLLECTIONS-MT. MADRONO 31:254-257
COMMENTS: VOUCHER - LESICA, P. (1778). 1981. MONTU, MONT.

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau (10-mile radius)

EOCODE: PDAST8H022.001 SITE NAME:
NAME: SENECIO AMPLECTENS VAR HOLMII GRANK: G? SRANK: S1 FEDERAL STATUS:
COMMON NAME: CLASPING GROUNDSEL LAST OBSERVATION: 1955-08-04 PRECISION: M
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 19 TRS COMMENTS: LATITUDE : 450148 LONGITUDE: 1092550
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 7680 ACREAGE: 0
DIRECTIONS: RIM OF BEARTOOTH MOUNTAINS, JUST WEST OF QUAD CREEK; 23 MILES SOUTHWEST OF RED LODGE.

HABITAT DESCRIPTION: IN COARSE GRANITIC-SCHISTOID, WEST-FACING, RELATIVELY STABLE TALUS.

ELEMENT DATA: PLANTS FIBROUS-ROOTED WITH STOUT SHORTLY-BRANCHED CAUDEX. HEADS YELLOW, 1-2.

BEST SOURCE: CRONQUIST (5089). 1955. SPECIMEN #248436 RM.

COMMENTS: NONE.

EOCODE: PDAST8H1E0.001 SITE NAME:
NAME: SENECIO FUSCATUS GRANK: G4 SRANK: S2 FEDERAL STATUS:
COMMON NAME: TWICE-HAIRY BUTTERWEED LAST OBSERVATION: 1978-07-26 PRECISION: M
EORANK: EORANK COMMENTS:
MANAGED AREAS: CUSTER NATIONAL FOREST
COUNTY: CARBON
QUAD NAME: BLACK PYRAMID MOUNTAIN QUAD CODE: 4510914
TOWNRANGE: 009S019E SECTION: 32 TRS COMMENTS: N2 LATITUDE : 450020 LONGITUDE: 1092410
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 10200 ACREAGE: 0
DIRECTIONS: BEARTOOTH HIGHWAY AT WYOMING LINE.

HABITAT DESCRIPTION: ALPINE MEADOW WITH POLYGONUM, TRIFOLIUM. GENTLE, OPEN, GRANITIC SLOPES.

ELEMENT DATA: RAYS ORANGE-YELLOW.

BEST SOURCE: DORN,R.D. (3167). 1978. SPECIMEN #310311 RM.

COMMENTS: ALSO COLLECTED BY CRONQUIST (7996). 1955. SPECIMEN #248336 RM.

Montana Natural Heritage Program
Special Plant Occurrences: Line Creek Plateau (10-mile radius)

EOCODE: PDAPI26010.001 SITE NAME: GROVE CREEK PINNACLES
NAME: SHOSHONEA PULVINATA GRANK: G3 SRANK: S1 FEDERAL STATUS: C2
COMMON NAME: SHOSHONEA LAST OBSERVATION: 1986-06-24 PRECISION: SC
EORANK: A EORANK COMMENTS: THREE LARGE, UNDISTURBED SUBPOPULATIONS.
MANAGED AREAS: PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
BILLINGS RESOURCE AREA
BLM MILES CITY DISTRICT OFFICE
COUNTY: CARBON
QUAD NAME: TOLMAN FLAT QUAD CODE: 4510912
TOWNRANGE: 006S020E SECTION: 26 TRS COMMENTS: N2NW4,E2SW4;23W2 LATITUDE : 450629 LONGITUDE: 1091339
WATERSHED: 10070006 PHYSICAL PROVINCE: MR ELEVATION: 7140 ACREAGE: 50
DIRECTIONS: CA. 5 AIR MILES SSE. OF RED LODGE; HWY. 308 FROM BRIDGER TO
BELFRY, THEN HWY. 307 S. 4.5 MI. TO GROVE CR. RD.; GO W. 5
MI. TO RANCH, GO LEFT, THEN RT. AND CROSS S. FORK GROVE CR.
HABITAT DESCRIPTION: GRAVELLY LIMESTONE SOILS ON WINDBLOWN RIDGE TOPS, AMONGST
SCATTERED PINUS FLEXILIS & PSEUDOTSUGA MENZIESII; WITH
ERITRICHIUM HOWARDII, CYMOPTERUS HENDERSONII, KELSEYA.
ELEMENT DATA: EST. 6000-8000 PLANTS, IN FLOWER & FRUIT; THREE VERY LARGE
AND VIGOROUS SUBPOPULATIONS, WITH THE ELEMENT AS THE
DOMINANT GROUND SPECIES; SITES ARE ALMOST COMPLETELY
UNDISTURBED, WITH NO WEEDS; EST. 3000-4000 PLANTS IN S.SITE.
BEST SOURCE: SHELLY, J.S. 1986. FIELD SURVEYS IN CARBON COUNTY OF 23-27
JUNE; WITH P. LESICA.
COMMENTS: RECENTLY DESCRIBED GENUS AND SPECIES (SYST. BOT. (1982) 7:
471); LESICA, P. (8417), 1985, SPECIMEN #102363 MONTU.

* * *

EOCODE: PDAST9C0M0.001 SITE NAME: GROVE CREEK
NAME: TOWNSENDIA SPATHULATA GRANK: G3 SRANK: S2 FEDERAL STATUS: SC
COMMON NAME: SWORD TOWNSENDIA LAST OBSERVATION: 1986-06-24 PRECISION: SC
EORANK: B EORANK COMMENTS:
MANAGED AREAS: BILLINGS RESOURCE AREA
BLM MILES CITY DISTRICT OFFICE
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
COUNTY: CARBON
QUAD NAME: TOLMAN FLAT QUAD CODE: 4510912
TOWNRANGE: 006S020E SECTION: 35 TRS COMMENTS: 26W2N2,23SW4 LATITUDE : 450533 LONGITUDE: 1091321
WATERSHED: 10070006 PHYSICAL PROVINCE: BH ELEVATION: 6200 ACREAGE: 50
DIRECTIONS: TAKE HWY 308 FROM RED LODGE ABOUT 5 MILES TO JUST PAST STRIP
MINE. FOLLOW UNIMPROVED ROAD SOUTH OF HIGHWAY ABOUT 6 MILES
TO NORTH FORK OF GROVE CREEK.
HABITAT DESCRIPTION: LIMESTONE LITHOSOL AND TALUS; DOUGLAS FIR-LIMBER PINE
FELLFIELD, WITH ANTENNARIA, ERITICHIUM HOWARDII, SENECIO
CANUS, CYMOPTERUS TEREBINTHINUS.
ELEMENT DATA: EST. 51-100 PLANTS, IN 4 SMALL SPARSE SUBPOPULATIONS; SEED
DISPERSING; NO EVIDENCE OF DISTURBANCE.

BEST SOURCE: LESICA, P. 1986. FIELD SURVEY IN CARBON COUNTY OF 23-27
JUNE. VOUCHER-(8402) UM.
COMMENTS: ENTIRE AREA HAS NOT BEEN SEARCHED.

WILDLIFE RESOURCES

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WILDLIFE TECHNICAL REPORT

INTRODUCTION

The assessment and recommendations contained within this Wildlife Report are based on inputs derived from (1) a two-day on-site visit and walk-through of the access alternatives and drill sites on October 4 and 5, 1988, and a one-day on-site ground survey on May 2, 1989, (2) a helicopter reconnaissance of the area on November 11, 1987, and fixed-wing aerial surveys on April 15 and 21, (3) personal and telephone interviews with concerned parties and biological specialists, (4) meetings with state and federal agency specialists in Red Lodge, Billings, and Cody, (5) examination of pertinent data in state and federal agency files and (6) the review of pertinent literature.

Individuals personally interviewed during the fact finding process include Mr. Shawn Stewart, District Biologist, Montana Department of Fish, Wildlife, and Parks (MDFWP), Red Lodge; Dr. Fred Van Dyke, Research Biologist (MDFWP), Red Lodge; Mr. Larry Roop, Grizzly Bear Specialist and District Biologist, Wyoming Game and Fish Department (WG & FD), Cody. In addition, telephone interviews were conducted with Dr. Richard Knight, Leader, Interagency Grizzly Bear Study Team, U.S. Park Service, Bozeman; Mr. Rob Hazlewood and Mr. Dale Harmes, Threatened and Endangered Species Regulatory Authorities, U.S. Fish and Wildlife Service, Helena; Dr, Harold Picton, Professor of Zoology, Montana State University, Bozeman; Mr. Dan Bricco, District Wildlife Management Biologist, BLM, Miles City; Mr. Eric Greenquist, Resource Area Wildlife Management Biologist, BLM, Cody; Mr. Robert Oakleaf, Non-Game Coordinator, (WGFD), Lander; Mr. Dennis Flath, Montana Department of Fish and Wildlife, and Parks Non-game Biologist, Bozeman; Mr. Forrest Hammond, Wyoming Game and Fish Department Grizzly Bear Biologist, Cody, Mr. Bruce Anderson, Wildlife Biologist, USFS, Black Hills National Forest, Deadwood, Mr. Dennis Christopherson, Threatened and Endangered Species Regulatory Authority, U.S. Fish and Wildlife Service, Billings, and Mr. John Edwards, Custer National Forest Wildlife Biologist, USFS, Billings.

WILDLIFE TECHNICAL REPORT

AFFECTED ENVIRONMENT

Affected environment includes the proposed drill sites, access roads, and the zones of influence surrounding these drill sites and access roads. The evaluation of access road alternatives and variations includes both new road construction as well as existing roadways that will be utilized during the project (Exhibit D-1).

Habitat Types

Seven primary wildlife habitat types are associated with the proposed drill sites and road construction. Five of these types correspond with the vegetation types described in detail in the Vegetation Technical Report, and one (rock cliffs), does not involve vegetation. The seven habitat types include (1) sagebrush scrub, (2) limber pine woodland, (3) mixed conifer, (4) alpine bunchgrass and forbland, (5) riparian cottonwood and willow, (6) agricultural land, and (7) rock cliffs. Although variation in topography and soil moisture levels produce some interfingering of habitat types, habitat types 1 through 4 above are numbered in the same general order as their occurrence along the elevational gradient, with sagebrush scrub occurring at the bottom and alpine bunchgrass and forbland occurring at the top. The rock cliff habitat occurs at the upper reaches of mixed conifer type and extends up into and through the alpine bunchgrass and forbland. The riparian cottonwood and willow type occurs along drainage courses at mid to lower elevations.

Endangered and Threatened Wildlife Species

No species listed as threatened, endangered, or which is a candidate for listing as a T or E species, is known to inhabit or frequent either drill site or access alternative. However, several such species are known to occur occasionally or periodically in the area (bald eagle and peregrine falcon). Hacked peregrines have been sighted in the general region and one active peregrine nest occurs within a 50-mile radius of the proposed activity (Oakleaf 1988, Flath 1988, Roop 1988). Although the proposed action is not likely to impact this species, it is possible that new nests will be established in this region in the future (Oakleaf 1988). Although no nesting is known to occur, bald eagles are known to hunt in the area during the winter months (Stewart 1988).

No classified grizzly bear habitat occurs on or in the near vicinity of the project area and there are no records of grizzly bear sightings either along the eastern front of the Line Creek Plateau or on the big game winter range along the Montana/Wyoming state line (Roop 1987, 1988; Stewart 1988). The nearest classified grizzly bear habitat consists of Management Situation II and occurs approximately 10 miles southwest of the project area on the Shoshone National Forest (Exhibit D-2). The potential for a grizzly bear sighting exists, but the probability of occurrence is very low (Roop 1988).

No confirmed black-footed ferret sightings have been made in or near the project area and only marginal habitats for this species exist in the entire region (Stewart 1988, Flath 1988). There are no records of ferruginous hawk sightings in the vicinity of the proposed project and occurrence of this species is unlikely (Flath 1988). According to Flath (1988), apparently suitable habitats exist for several other species for which there are no records of sightings (Swainson's hawk, mountain plover, long-billed curlew, and

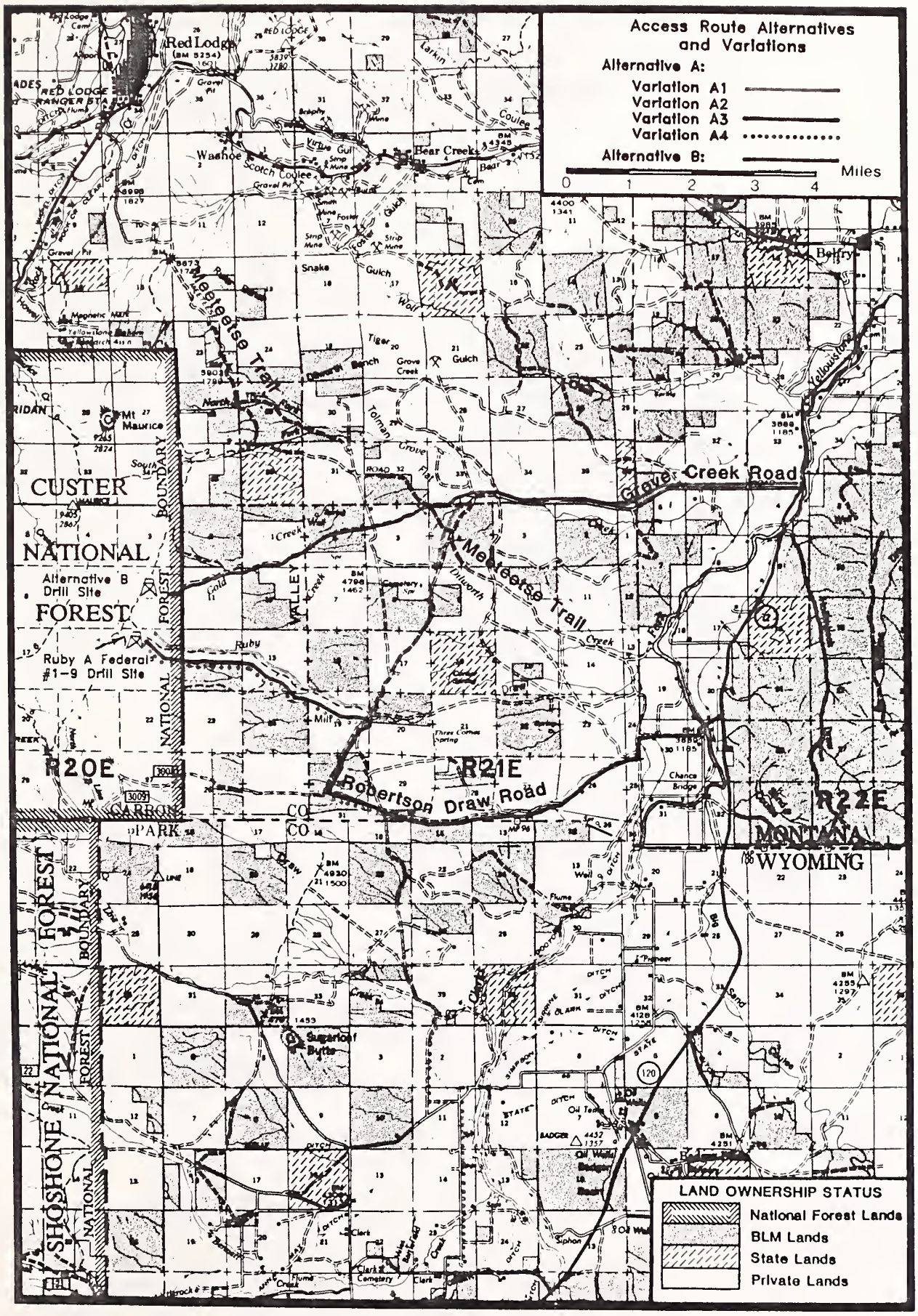

Exhibit D-1. Location of Alternative A Access Route and Routing Variations and Alternative B Access Route.

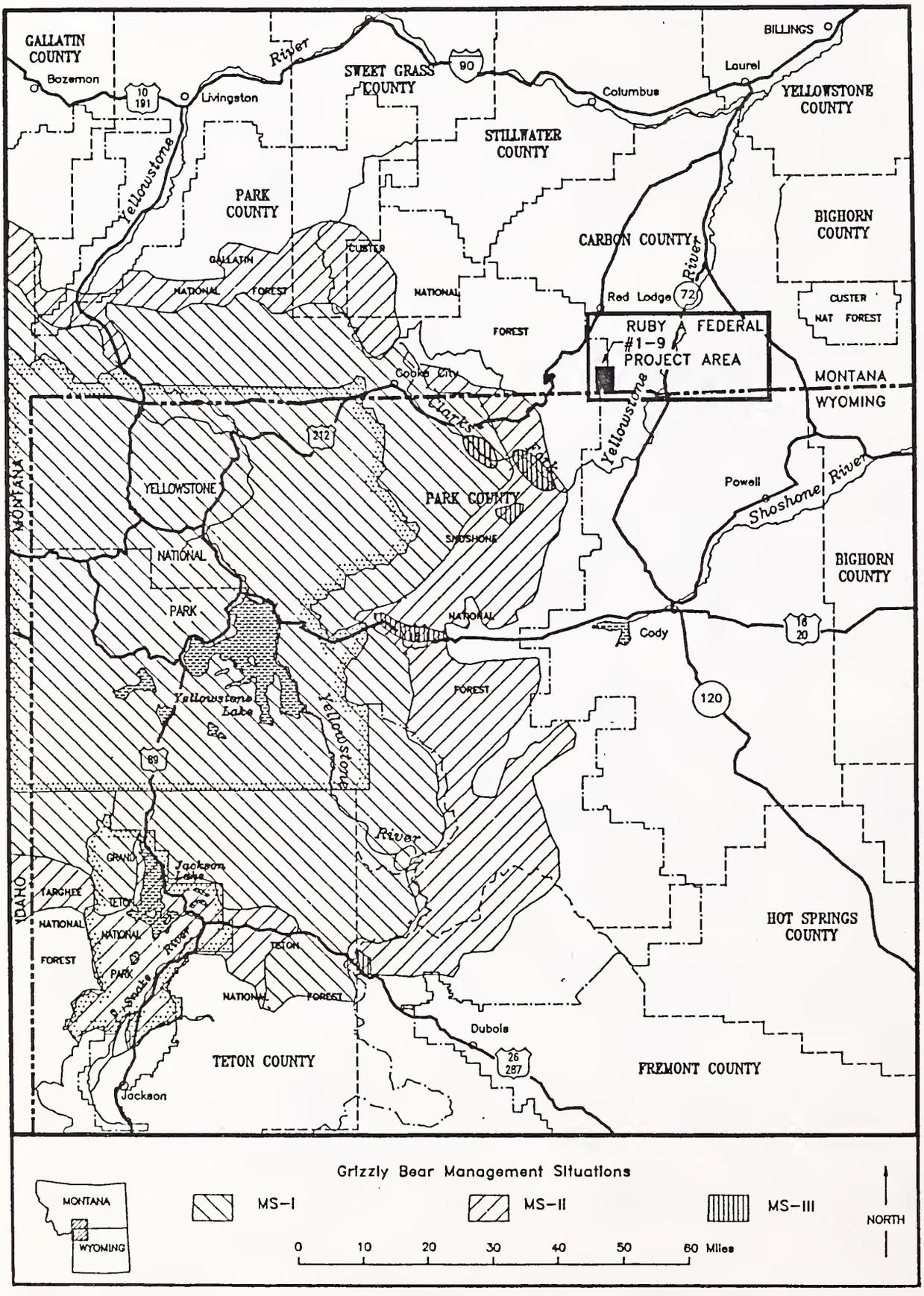

Exhibit D-2. Grizzly Bear Habitats in the Greater Yellowstone Area.

spotted bat). Marginal or peripheral habitats for the North American wolverine and lynx occur on both drill site alternatives but there are no records of sightings and the probability of occurrence is very low (Flath 1988).

The probability of occurrence of T and E and Candidate species is considered in more detail in the remainder of this document under the respective access and drill site alternatives.

Major-Interest Wildlife Species

The proposed and alternative drill sites, and the access alternatives leading to these sites, pass through habitats of several species listed in the Management Plan for the Custer National Forest as major-interest wildlife species (USFS 1986.) These habitats include elk winter and fall/rutting range, spring/calving habitat, and migration corridors, and year-round habitats of pronghorn, mule deer, and white-tailed deer. The habitats of four species listed as management indicator species for the Custer National Forest (USFS 1986) occur on or adjacent to the drill sites and access alternatives. These species include Brewers sparrow, northern oriole, yellow warbler, and goshawk. Habitats of several other wildlife species that occur adjacent or proximal to the proposed drill sites or the new and existing roads that constitute the access alternatives to the drill sites include white-tailed prairie dogs, year-round sage grouse habitat, spring nesting and early fall blue grouse habitat, spring and fall black bear habitat, and nesting and foraging habitats for prairie falcons.

Elk

Both the proposed and the alternative drill sites are located near the northern edge of the winter range for the Line Creek elk herd (Exhibit D-3). This winter range extends across the state line into Wyoming and supports elk from both Montana and Wyoming. One of the stated objectives in the Management Plan for the Custer National Forest (Management Area C) is to "manage the Line Creek Elk habitat area to improve elk winter range" and, specifically, to "manage to improve the quantity and quality of forage and to provide adequate cover (thermal and hiding)." - - "Other uses are allowed to the extent that they do not conflict with elk use" (USFS 1986). Approximately 400 elk winter on these borderline slopes, with roughly 120 - 140 of these animals from Montana origins and 260 -280 moving up from Wyoming (Stewart 1988, Van Dyke 1988, Roop 1988). According to Van Dyke (1989) and Stewart (1989) the Montana portion of this herd is growing and has increased by 135% since 1977.

Other Species

Other typical wildlife species that occur in the area include pronghorn antelope, coyote, cottontail rabbit, red squirrel, porcupine, chipmunk, pocket gopher, golden eagle, prairie falcon, goshawk, Hungarian partridge, chukar partridge, western tanager, raven, robin, Townsend's solitaire, brown creeper, grey jay, loggerhead shrike, Clark's nutcracker, Cassin's finch, pine grosbeak, dark-eyed junco, black-capped chickadee, and white-crowed sparrow. Mountain lions are also reported to make occasional use of the area (Stewart 1988 and Van Dyke 1989). Van Dyke (1989) states that he has sighted

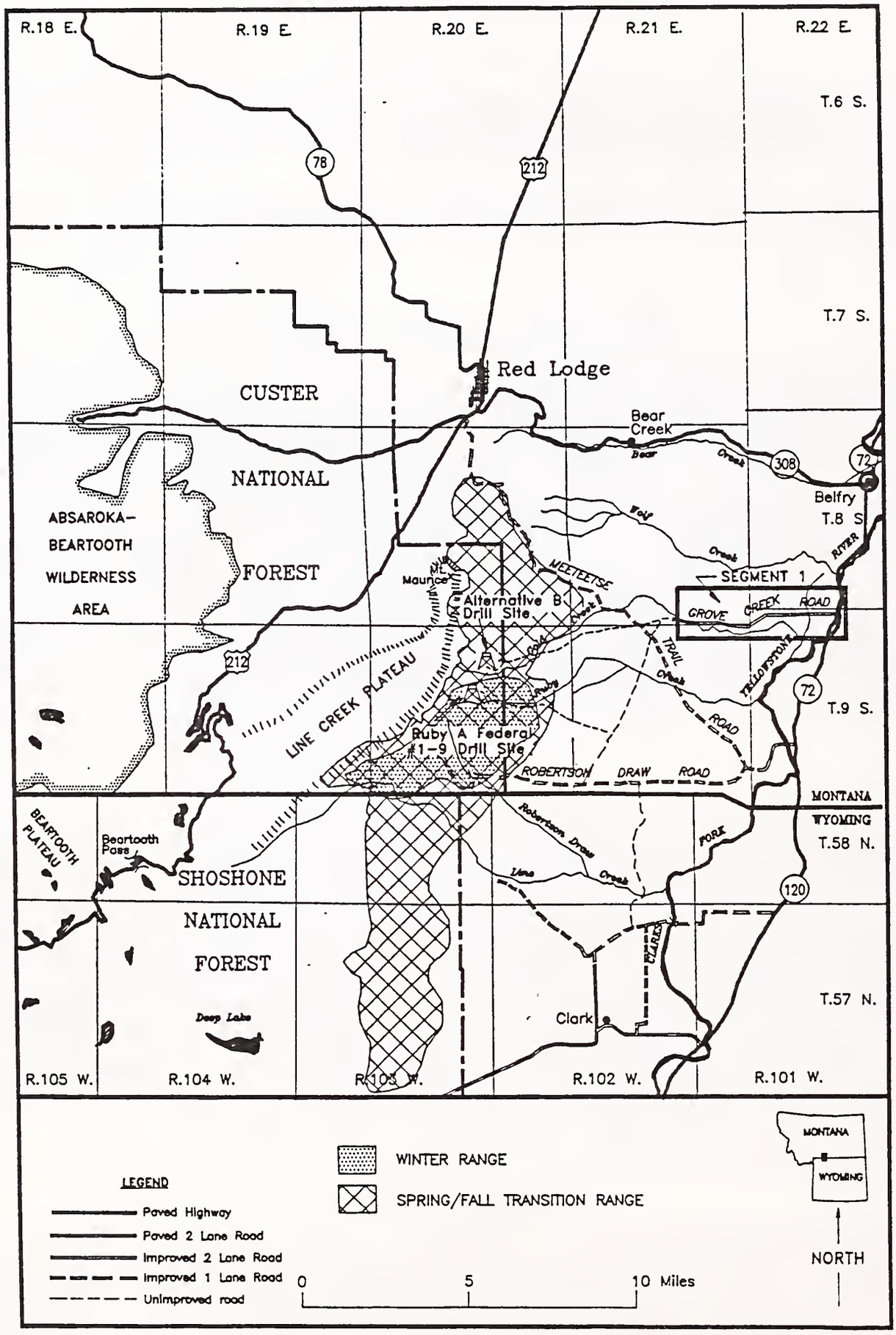

Exhibit D-3. Sensitive Elk Habitats in the Ruby A Federal No. 1-9 Project Area and Segment 1 of the Access Routes.

cougar tracks along the face and ridgelines of the area but not in the draws of either Ruby or Gold Creeks. He feels that the lions are in the area to pursue mule deer.

Wildlife Use

Although the potential for recreational viewing and study of wildlife on the proposed project area exists, by far the greatest single use is for recreational hunting (USFS 1986). Elk, mule deer, white-tailed deer, pronghorn, black bear, blue grouse, sage grouse, and Hungarian and chukar partridge, are game species which occur within the zone of influence of the proposed project. Although deer hunting provides the greatest amount of hunter recreation time on the Custer National Forest, elk are the most prized big game animal and public interest in this species is high (USFS 1986).

Both drill sites are located within fall/rutting and elk calving habitats of the Montana fraction of the elk herd (Exhibit D-3). Because of the additional security value provided by the more dense vegetative cover on the Ruby site, Stewart (1989) and Van Dyke (1989) feel that the quality of fall/rutting and calving habitats on the proposed drill site (Ruby Creek) is somewhat superior to that of habitats occurring on the alternative drill site (Gold Creek).

Calving activities, which are not extensive on either site, are never-the-less particularly important because of the currently low calf/cow ratio (36/100) and low productivity level in this herd (Van Dyke 1989 and Stewart 1989). Although fall range for the Montana elk extends from the top of the Line Creek Plateau down through the lower elevation toe slopes and is normally adequate and not limiting, current studies by Van Dyke (1989) indicate that it may be in short supply and become critical during extremely dry years when animals are forced to concentrate on the limited supply of moist habitats available in this area. Similarly, when extremely large amounts of snow accumulate on the Line Creek Plateau and upper face during an unseasonably early period in the fall, habitats available to elk are greatly reduced and the animals are rapidly constricted to the much more limited habitats along the lower elevation toe slopes (Stewart 1989 and Van Dyke 1989).

According to estimates based on a single year of data collected by Van Dyke (1989) during the fall of 1988 and earlier studies conducted by Stewart (1989), it appears that there are approximately 23 square miles of usable fall elk habitat during a year of normal or average climatological events. Both Van Dyke (1989) and Stewart (1989) emphasize that these are preliminary calculations, based on best current information available, and are subject to change pending the collection and analysis of new data currently being collected as part of an on-going study by Dr. Fred Van Dyke. Of these 23 square miles of normal fall habitat, only about 10 square miles are available to elk during drought years or fall seasons of unusually high snow fall (Van Dyke 1989). The 10-square miles of critical or core habitat are located on the east face of the Line Creek Plateau and includes the headwaters of both Ruby and Gold Creeks.

Alternative A

Drill Site

The drill site is located within spring/fall transition, fall/rutting, and winter range of elk (Exhibit D-4) in a sagebrush scrub clearing within the limber pine woodland habitat type. This area is traversed during fall and late spring migration periods by elk en route to and from winter range along the south and southeastern toe-slopes of the Line Creek Plateau near the Wyoming/Montana border (Exhibit D-3). Approximately 400 elk winter on these border-line slopes with roughly 120 - 140 animals being from Montana origins and 260 - 280 moving up from Wyoming (Stewart 1988, Van Dyke 1988; Roop 1988). At any one time approximately 40 - 60 individuals may be on, or proximal to, the drill site during the winter and spring/fall migration periods, with some elk, mostly bulls, remaining in the vicinity of the drill site all winter (Stewart and Van Dyke 1988). The heaviest concentration of elk in the area of the drill site occurs during late winter (March) through June as the animals work their way back to the high country, with some cows remaining late enough to drop calves (Van Dyke 1988). According to Van Dyke (1988) the saddle or topographic bench on which the proposed drill site is located, lies on a route heavily traveled by elk moving between drainages.

Low numbers of mule deer utilize the drill site and surrounding habitats the year-round and move through this area during their spring/fall migrations to winter range north and east of the drill site. Concentrations of deer do not occur in this area during the mid-winter months (Stewart 1988). The density of black bears at the heads of drainages along the east-facing toe slopes of the Line Creek Plateau is relatively high. These habitats, which include the drill site, are utilized extensively by bears during the spring months. Bears utilize the mixed conifer habitat type upslope from the drill site during the fall when the nuts of the white-barked pines in this habitat constitute an important component of the bears diet (Stewart 1987 and 1988). During years when the white-bark pine nut crop is poor bear use at lower elevations, including the drill site, may be high (Stewart 1989). Black bear use on and around the drill site is evidenced by the number of rocks and small boulders that have been moved by bears in their search for the food organisms, such as grubs, ants, insects, rodents, etc.

Nesting and brood-rearing habitats of blue grouse occur on and around the drill site. This species leaves the drill site area during the fall and migrates to winter range at higher elevations (Stewart 1988). Golden eagles occur in the area and are commonly seen riding the updrafts along the cliff faces above the drill site to the west and north. No eagle nests are known to occur in the area (Stewart 1988, Flath 1988), but there is suitable nesting habitat in the cliffs several miles to the north and south of the drill site and it is probable that a nest exists (Anderson, 1989). Bald eagles do not nest in this area (Oakleaf 1988, Stewart 1988, Flath 1988) but do concentrate along major waterways, such as the Clark's Fork of the Yellowstone River (Clark's Fork), during the winter months and radiate outward from these corridors to hunt. Because of its distance from the river and general lack of a substantial winter prey base for raptors, the drill site is probably not frequently used by bald eagles. However, this species is known to make at least occasional use of the area and has been observed soaring along the cliffs adjacent to the drill site during the winter (Stewart 1988).

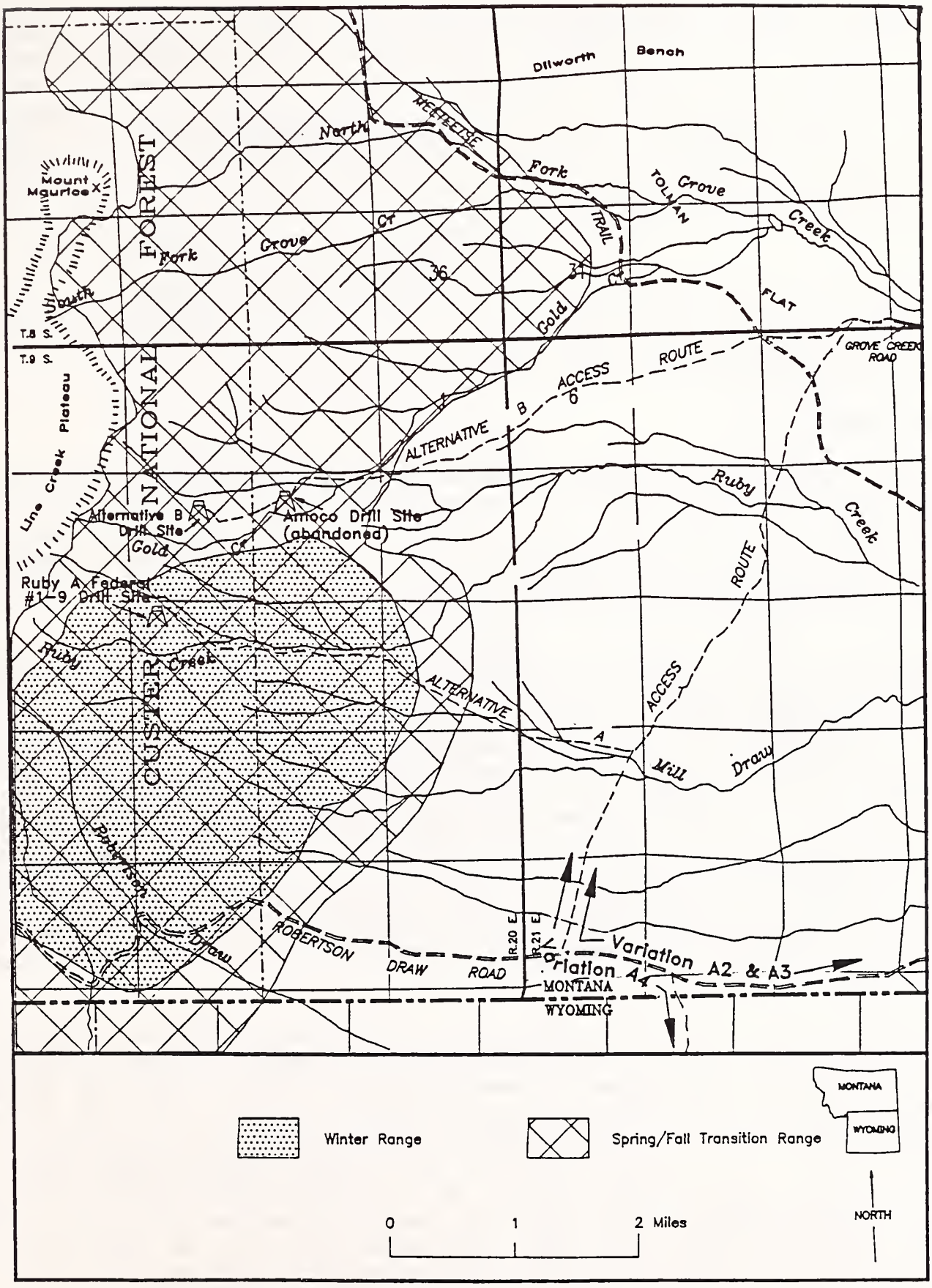

Exhibit D-4. Elk Winter and Spring/Fall Transition Range in Relation to Alternative A and Alternative B Drill Sites and Access Routes.

The sagebrush stands on and adjacent to the drill site constitute suitable spring and summer habitats for Brewer's sparrow, a management indicator species for sagebrush habitats on the Custer National Forest (USFS 1986). Although this species was not observed during the site inspection on October 4, 1988, it is likely that it breeds and nests here. Known distribution records and habitat requirements of the spotted bat, a Category 2 Candidate Species, indicate that this species might occur in the vicinity of the proposed project (Taylor 1988, Snow 1974), but no specimens have been collected and no observations have been made. Goshawks are known to occur in the general vicinity of the drill site but there are no documented nest locations (Stewart 1988).

Both the North American lynx and the wolverine are known to occur in the greater region surrounding the project area (Reeve et al.1986). However, habitats in the project area are less than ideal and there are no sightings records of either species in the vicinity of the proposed project (Flath 1988).

Access Route

Alternative A accesses the proposed drill site via roads from the east which extend westward from State Highway 72 for approximately 14.14 miles to the drill site (Exhibit D-1). This 14.14 miles of access road is broken into four different segments based on the nature of the existing road, if any, and the magnitude or extent of proposed improvements and construction (Exhibits D-3 and D-5; Table D-1). The types of wildlife habitats traversed by each of these segments are described below.

Existing County Road. This access segment consists of 5 miles of improved, gravel-surfaced county road extending westward from State Highway 72 to its end in SWSW34:T8S:R21E (Exhibit D-3; Table D-1). The first 2 miles of this segment of road traverses agricultural lands and the remaining 3 miles intersect sagebrush scrub habitat. This segment of road intersects no officially designated critical wildlife habitats but several important wildlife species are likely to occur in habitats adjacent to the road. Mule deer, Hungarian partridge, and chukar partridge are year-round residents of the river bottom/ riparian corridor along the Clark's Fork and forage outward from this corridor for several miles into the adjacent agricultural and sagebrush habitats (Stewart 1988). These species can be expected to occur throughout the entire segment of the county road access. Mule deer concentrate in the agricultural fields and pastures along the eastern two-thirds of this road segment during the fall, winter, and spring seasons (Exhibit D-6).

One sage grouse lek occurs north of the county road segment in Section 30:T8S:R22E (Exhibit D-7). Suitable nesting and foraging habitat exist nearby and these birds could be encountered along this segment of road during any month of the year. Suitable habitat for Swainson's hawk exists along this segment of access but no nest locations are documented (Flath 1988, Stewart 1988). No sighting records for mountain plover or long-billed curlew exist for the vicinity of the proposed project (Flath 1988), but habitats similar to those in which these species were sighted along the Clark's Fork in Wyoming, approximately 10 miles south, do occur along portions of the county road segment (Greenquist 1988, Roop 1988). Bald eagles are known to occur along the Clark's Fork during the winter months and undoubtedly hunt the area bisected by the county road segment (Oakleaf 1988, Flath 1988, and Stewart 1988). Golden eagles may also hunt the western portion of this access segment. Only one known prairie dog town

Table D-1. **Current status and proposed construction for the Alternative A road access.**

Access Segment	Description/Current Status (See Exhibit D-1)	Proposed Improvements	Length (miles)
1	Improved, gravel-surfaced county road extending between State Hwy. 72 westward to its end in SWSW34:T8S:R21E.	None	5.0
2	Five miles of unimproved dirt and gravel road; three miles of two-track trail. Extends between the western end of the county road in SWSW34:T8S:R21E to the eastern boundary of the Custer National Forest.	Varies from heavy re-construction to minor blading.	8.0
3	Two track roadway extending between the eastern boundary of the Custer National Forest to the termination of this track in SWSW10:T9S:R20E.	New road construc-tion	0.83
4	New road construction across un-roaded terrain. Extends between the upper end of the two-track access in SWSW10:T9S:R20E and the drill site in NWNW15:T9S:R20E.	New road construc-tion	0.31

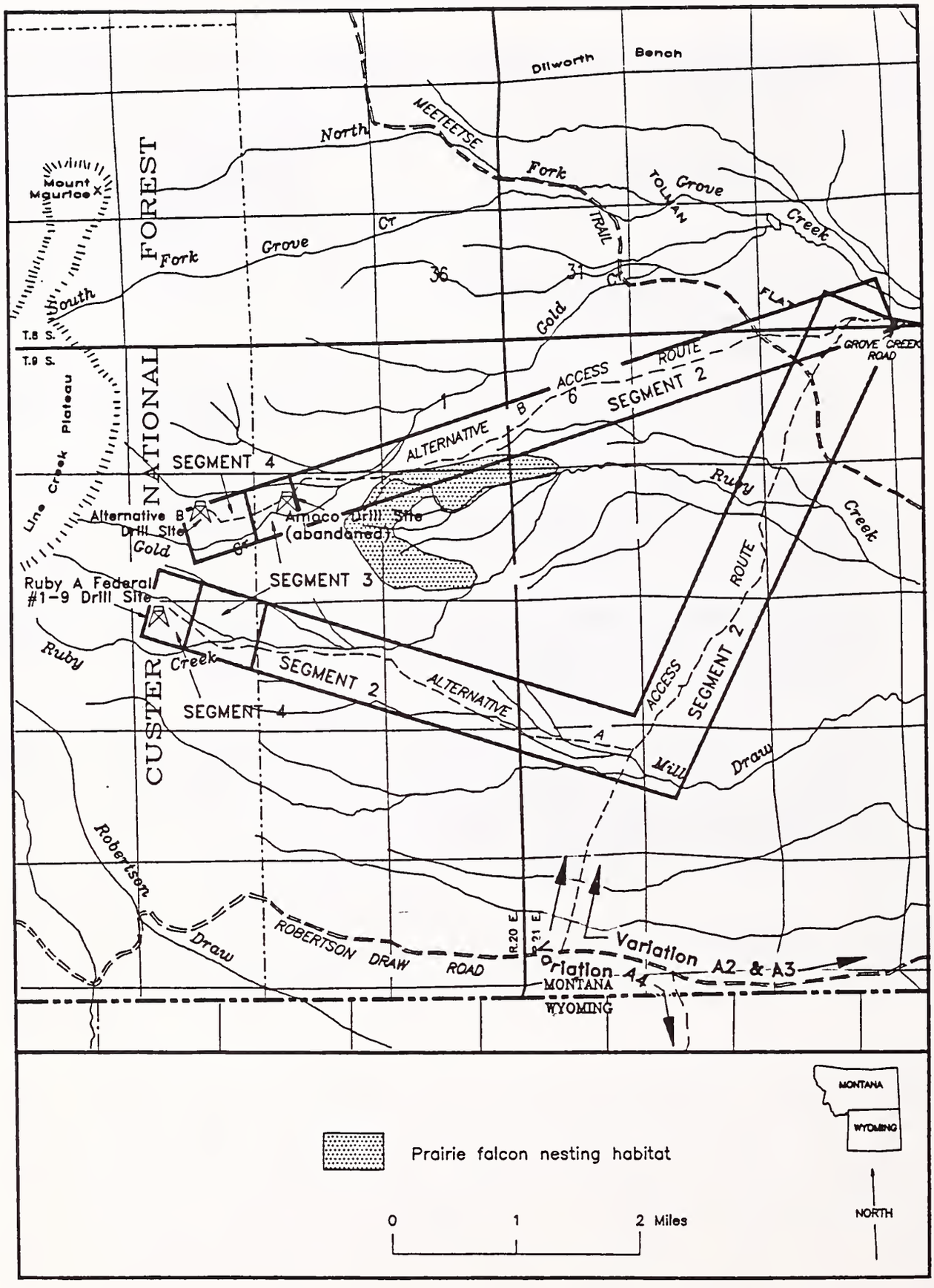

Exhibit D-5. Prairie Falcon Nesting Habitat and Segments 2 through 4 of Access Alternatives A and B.

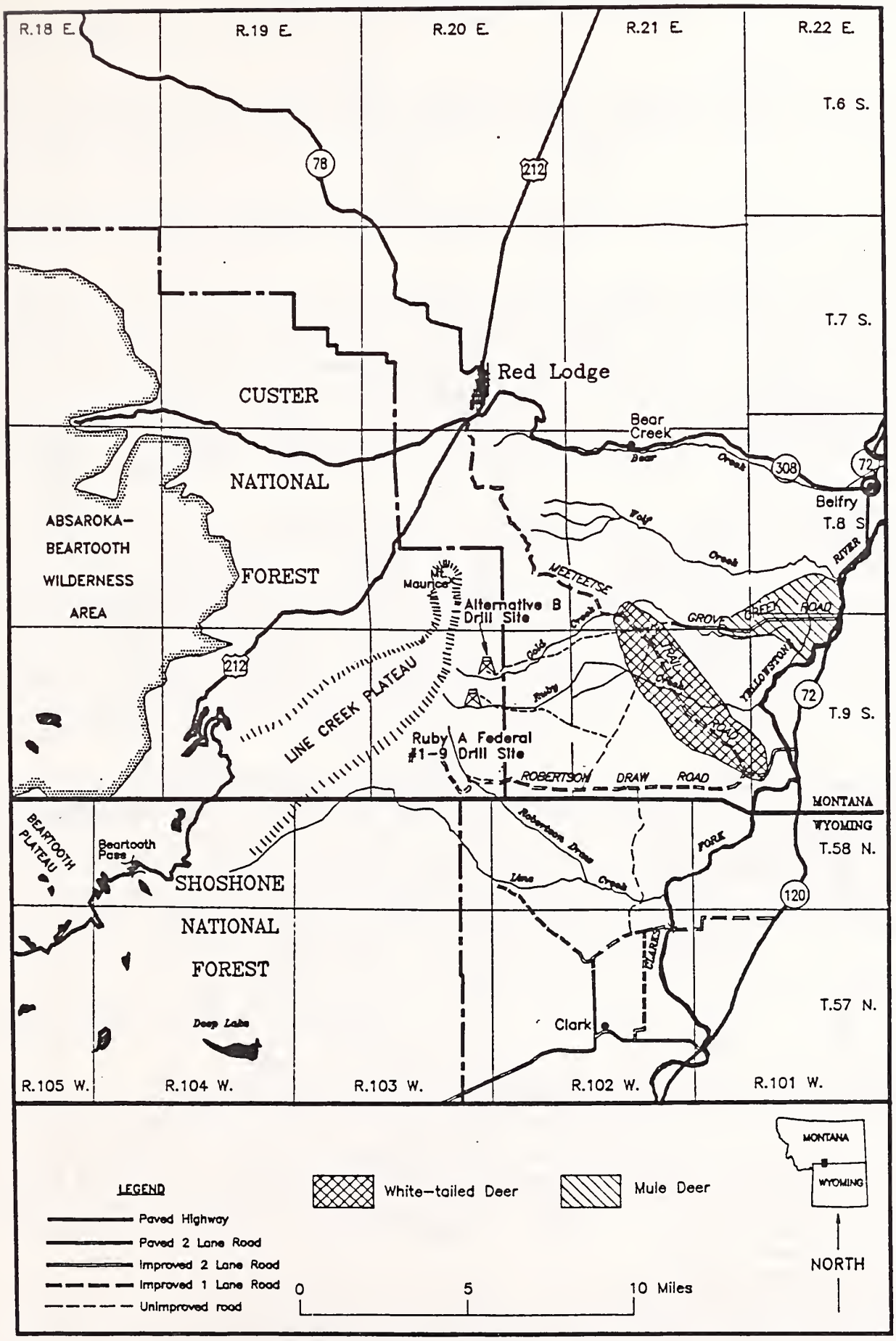

Exhibit D-6. Concentration Areas of Mule Deer and White-Tailed Deer along Alternative A and Alternative B Access Routes.

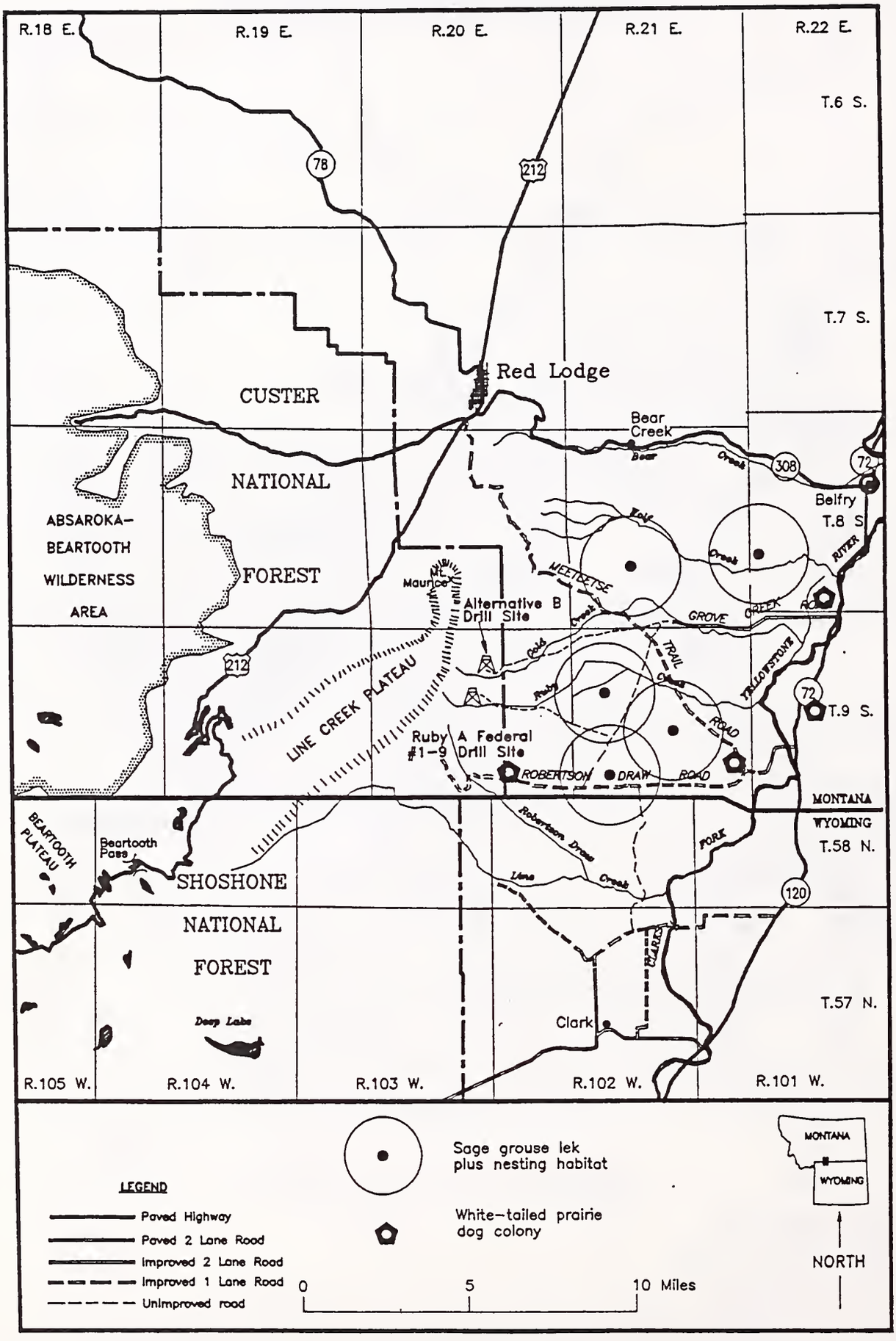

Exhibit D-7. Locations of White-tailed Prairie Dog Colonies and Sage Grouse Leks along Alternative A and Alternative B Access Routes.

occurs along this access segment. According to Flath (n.d.) this colony consists of only 2 acres and is located at least 1/2-mile north of the road in Section 33:T8S:R22E (Table D-2; Exhibit D-7).

No improvements or reconstruction is proposed for the 5 mile segment of county road which will be used (Table D-1).

Segment 2. This access segment consists of 8 miles of unimproved roadway extending between the west end of the county road in SWSW34:T8S:R21E, and the eastern boundary of the Custer National Forest (Exhibit D-5; Table D-1). Approximately the first five miles of this access consists of unimproved dirt and gravel road, while the last three miles consists of two-track trail. This entire segment of access bisects sagebrush scrub habitat, but,in the upper or western-most 1.2 miles,closely parallels the riparian corridor along Ruby Creek and traverses the edge between the limber pine and sagebrush scrub habitat types for about 1/2-mile.

This segment traverses habitats of sage grouse, pronghorn, prairie falcons, white-tailed jackrabbit, cottontail rabbit, and possibly Swainson's hawk, as well as white-tailed deer winter range and movement corridor (Exhibit D-6). Mule deer may be encountered occasionally. The access passes within approximately 0.75 miles of a block of limestone cliffs that offer apparently suitable nesting habitat for prairie falcons (Exhibit D-5). Based on his field sightings of prairie falcons in and around these cliffs, Anderson (1989) feels that an aerie is probably present. The habitats along this access segment are hunted all year by golden eagles and during the winter months by bald eagles (Stewart 1988).

This roadway passes within approximately 1/2-mile of one sage grouse lek in SWSW8:T9S:R21E and within 1.2 miles of a second lek in West-Central 29:T9S:R21E (Exhibit D-7). Since the majority of sage grouse hens using a given lek nest within a 1.5-mile radius of that lek, this segment of access will traverse approximately 3.7 miles of nesting habitat. The access does not intersect any prairie dog colonies, but passes within approximately 1.75 miles of the white-tailed prairie dog colony of about 250 acres (Flath n.d.) located in Sections 26/27:T9S:R20E (Exhibit D-7).

Improvements to this segment of access will vary from heavy reconstruction to minor blading (Table D-1).

Segment 3. This segment of access consists of 0.83 miles of two-track roadway extending between the eastern boundary of the national forest and the termination of this track in SWSW10:T9S:R20E (Exhibit D-5; Table D-1). A short section (0.13-mile) of the upper or most western portion of this access segment bisects the limber pine habitat type. The remaining length of roadway (0.70-mile) bisects sagebrush scrub habitat which is tightly interfingered in a vegetative mosaic with the limber pine, mixed conifer, and riparian habitat types.

This segment of access bisects the habitats of the same wildlife species listed under Alternative A - Drill Site and the description of affected environment presented in that section applies equally to this section of roadway. In addition, this access segment both crosses and closely parallels the riparian habitat type which may provide suitable

Table D-2. **Locations, size, and land ownership of white-tailed prairie dog colonies in the vicinity of the Phillips Petroleum Company Ruby A Federal Exploratory Drill Sites and access alternatives.**

Colony Location	Estimated Size (acres)	Land Ownership (acres)
S33:T8S:R22E	2	Private (2)
S16,S17,S20:T9S:R22E	75-100	Private (75-100)
S24:T9S:R21E	19	Private (19)
S26,S27:T9S:R20E	248	Private (176) USDA-FS (48) USDI-BLM (24)

(Source: Flath n.d.)

spring and summer habitats for the northern oriole and yellow warbler, which are both management indicator species for riparian tree and shrub habitats on the Custer National Forest (USFS 1986). Improvements to this segment of access will consist of new road construction (Table D-1).

Segment 4. This segment of access consists of 0.31 miles of new road construction extending between the upper end, or termination of, the two-track access in SWSW10:T9S:R20E and the drill site in NWNW15:T9S:R20E (Exhibit D-5; Table D-1). This entire segment traverses the limber pine habitat type and bisects the habitats of the same wildlife species listed under Alternative A - Drill Site. The description of affected environment presented in that section applies equally to this segment of roadway.

Alternative A Roading Variations

In addition to the proposed access route, three access route variation to the proposed drill site have been identified by the BLM and FS for consideration. These routes are shown on Exhibit D-1. In general, the wildlife resources associated with these four access variations are similar. Differences between them, as well as potential impacts that could occur as a result of their implementation, are compared and summarized the in the Environmental Consequences section of this document.

Alternative B

Drill Site

This drill site exhibits habitats of the same wildlife species as the Alternative A Drill Site and, with a few exceptions, the description of affected environment for the Alternative B drill site is identical to that presented in the section entitled Alternative A - Drill Site. One of the exceptions involves the intensity and timing of elk use of the area.

Although the nature of elk use on the two drill site alternatives is similar, elk tend to leave the Gold Creek site earlier in the fall and return to it later in the late winter/early spring than they do the Ruby Creek site (Stewart 1988). Past observations by Stewart (1988) have indicated that the Ruby Creek site has been the northern extreme of the main winter range for elk, while the Gold Creek site lies just outside of this range (Exhibit D-4). He observed that cows and calves utilize the winter range as far north as Ruby Creek, and that mainly bulls utilize the area north of Ruby Creek up to the Gold Creek drill site. However, preliminary analyses of recent locations of radioed elk conducted by Van Dyke (1989) in his current study indicate that the winter range may now extend further north. Final analyses of these data are currently being conducted. The results of these analyses should be incorporated into the final maps, assessments, and narratives for this project.

The Gold Creek site also differs from the Ruby Creek site in the fact that mule deer do not occur year-round, but use the area only during the early and late winter, and during spring/fall migrations (Van Dyke 1989 and Stewart 1989).

Access Route

Alternative B accesses the proposed drill site via roads from the east which extend westward from State Highway 72 for approximately 11.20 miles to the drill site (Exhibit D-1). This 11.20 miles of access road is broken into four different segments based on the nature of the existing road, if any, and the magnitude or extent of proposed improvements and construction (Exhibits D-3 and D-5; Table D-3). The types of wildlife habitats traversed by each of these segments are described below.

Segment 1 - Existing County Road. This is the same segment of road previously described for the Alternative A access route in the section entitled Existing County Road. The description of affected environment for Segment 1 of the Alternative B access is identical to that presented for Alternative A.

Segment 2. This access segment consists of 5.33 miles of unimproved dirt and gravel roadway extending between the west end of the county road and the old Amoco drill site in Section 11:T9S:R20E. (Exhibit D-5; Table D-3). The eastern 4.23 miles of this segment of access bisects sagebrush scrub habitat, while the western 1.1 miles traverses limber pine habitat, and crosses the riparian habitat of Gold Creek in one place. The 4.23 mile segment of roadway which traverses sagebrush scrub bisects habitats of sage grouse, pronghorn, white-tailed deer movement corridor (Exhibit D-6), prairie falcons, white-tailed jackrabbit, cottontail rabbit, and possibly Swainson's hawk. Mule deer may be encountered occasionally. The sagebrush scrub portion passes adjacent to a block of limestone cliffs that offer apparently suitable nesting habitat for prairie falcons (Exhibit D-5). Based on his field sightings of prairie falcons in and around these cliffs, Anderson (1989) feels that an aerie is probably present. The sagebrush scrub segment of roadway passes within approximately 1.8 miles of the sage grouse lek in SWSW8:T9S:R21E, but does not traverse designated nesting habitat (Exhibit D-7). Because of the proximity of the lek and suitable nesting and foraging habitats, however, sage grouse could be encountered along this segment of road during any month of the year.

The 1.1-mile segment that traverses Limber Pine Habitat bisects habitats of the same wildlife species listed under Alternative B - Drill Site and the description of affected environment presented in that section applies equally to this section of roadway. In addition, this 1.1-mile segment both crosses and closely parallels the riparian habitat type which may provide suitable spring and summer habitats for the northern oriole and yellow warbler, which are both management indicator species for riparian tree and shrub habitats on the Custer National Forest (USFS 1986).

The habitats along all of the Segment 2 access are hunted all year by golden eagles and during the winter months by bald eagles (Stewart 1988). None of the Segment 2 access intersects any prairie dog colonies and, according to Flath, the nearest approach to a colony is approximately 3 miles (Sections 26/27:T9S:R20E, Exhibit D-7).

Improvements to this segment of access will vary from heavy reconstruction to minor blading (Table D-3).

Segment 3. This segment of access consists of 0.40 miles of two-track roadway extending between the old Amoco drill site in Section 11:T9S:R20E and the eastern boundary of the national forest (Exhibit D-5; Table D-3). This entire 0.40-mile segment

Table D-3. **Current status and proposed construction for the Alternative B road access.**

Access Segment	Description/Current Status (See Exhibit D-1)	Proposed Improvements	Length (miles)
1	Improved, gravel-surfaced county road extending between State Hwy 72 westward to its end in SWSW34:T8S:R21E.	None	5.0
2	Unimproved dirt and gravel road extending between the west end of the county road in SWSW34:T8S:R21E and the old Amoco to drill site Section 11:T9S:R20E.	Varies from heavy reconstruction to minor blading.	5.33
3	Two track roadway extending between the old Amoco drill site and the eastern boundary of the Custer National Forest.	New road construction.	0.40
4	Two-track roadway, trail, and unroaded topography extending between the eastern boundary of the Custer National Forest and the drill site in SWNE10:T9S:R20E.	New road construction	0.47

traverses limber pine habitat and bisects habitats of the same wildlife species listed under Alternative B - Drill Site and the description of affected environment presented in that section applies equally to this section of roadway. In addition, this 0.40-mile segment both crosses and closely parallels the riparian habitat type which may provide suitable spring and summer habitats for the northern oriole and yellow warbler, which are both management indicator species for riparian tree and shrub habitats on the Custer National Forest (USFS 1986).

Improvements to this segment of access will consist of new road construction (Table D-3).

Segment 4. This segment of access consists of 0.47 miles of two-track roadway, trail, and unroaded topography extending between the eastern boundary of the national forest and the Gold Creek Drill Site in SWNE10:T9S:R20E (Exhibit D-5; Table D-3). This entire 0.47-mile segment traverses limber pine habitat and bisects habitats of the same wildlife species listed under Alternative B - Drill Site and the description of affected environment presented in that section applies equally to this section of roadway. In addition, this 0.47-mile segment closely parallels the riparian habitat type which may provide suitable spring and summer habitats for the northern oriole and yellow warbler, which are both management indicator species for riparian tree and shrub habitats on the Custer National Forest (USFS 1986).

Improvements to this segment of access will consist of new road construction (Table D-3).

ENVIRONMENTAL CONSEQUENCES

Introduction

The principle impacts likely to be associated with the proposed access routes and drilling operations include (1) the temporary displacement of some wildlife species, (2) the loss of wildlife habitat, and (3) an increase in the potential for collisions between wildlife and motor vehicles.

Impact Significance Criteria

Criteria utilized in assessing the significance of wildlife impacts are based on best professional knowledge and opinions available. They were developed largely from information set forth in the scientific literature and in existing guidelines and standards of government regulatory agencies. In cases where few or no published guidelines exist, the professional judgement of appropriate wildlife specialists was utilized.

A. Impacts to general major interest wildlife species, including important game species, would be considered significant if:

1. Project-related activities impact an officially-designated crucial habitat during an important use period.

2. Short-term direct mortality (road kills, poaching, harassment, etc.) exceeds existing levels by 10%.

3. A permanent reduction in population recruitment rate occurs as the result of project activities.

4. Disruption of grouse or raptor breeding or nesting activities occurs.

5. The area of disturbance within a riparian habitat exceeded 1 percent of the total acreage of riparian habitats within the lease area.

B. Impacts to species of special concern such as federally listed threatened or endangered species, species proposed for listing, FS or State sensitive species and federal candidate species would be considered significant if:

1. The loss (death) of any individual from direct or indirect project-related causes, including but not limited to recruitment rate reductions to viable population, occurs.

2. A "may affect" determination was reached by the FS in the Biological Assessment required by Section 7 of the Endangered Species Act of 1973 (as Amended).

3. Project-related impacts would jeopardize or substantially decelerate the recovery program for any species.

Direct and Indirect Impacts

Alternative A - Drill Site

Considerations involved on the drill site include assessments of potential impacts on wintering elk and mule deer, migrating and calving elk, spring black bear use, breeding and nesting habitats of Brewer's sparrow and blue grouse, and general wildlife.

A total of 2.5 acres of limber pine habitat, consisting mostly of sagebrush vegetation, will be temporarily eliminated during the construction of the well pad and the stockpiling of topsoil. This will result in a small reduction in the amount of herbaceous and browse forage available to elk, deer, and other herbivores, such as blue grouse, cottontail rabbits, and rodents, which use the site. It will also result in a moderate reduction in the amount of nesting and escape cover available to species such as the Brewer's sparrow, blue grouse, and various other small birds and mammals.

The human activities associated with the construction, operation, and maintenance of the well and proximal access road will displace sensitive wildlife species. Elk, black bear, and, to a lesser extent, mule deer, will be the principle species affected. Since mule deer densities on this area are relatively low and most of these animals move further to the north and east for the winter (Stewart 1988) impacts to this species should be minor. The drilling operation will probably cause some deer to modify their activity patterns, but few are likely to be displaced from the general area and no significant impacts are expected (Van Dyke 1989 and Stewart 1989).

Elk will tend to avoid the drill site while there is sustained human activity there and can be expected to alter their movements and activity patterns so as to stay out of sight of the operation through the use of topography, timber, or darkness as cover. The displacement radius will vary according to availability of cover. Where exposed to similar drilling disturbances in Colorado, elk tended to avoid line-of-sight exposure over distances up to 0.75-1.0 mile during daylight hours, and placed either topography or dense vegetative cover, or both, between themselves and the drill site (Brekke 1985). Under the cover of darkness elk would probably substantially reduce their avoidance distance of the drill site with the proximity of their approach being limited by their tolerance of sounds produced there.

The magnitude and significance of elk displacement are likely to depend on the season of occurrence, the extent of comparable habitat alternatives available, the severity of the weather, and visibility or exposure of the drill rig and construction activities to elk (Brekke 1985). Displacement would be the most detrimental to elk during the dead of winter (December through February) and late winter (March-April) when weather conditions are most severe, animal condition is at its lowest, and comparable habitat alternatives are the most limiting. Displacement of elk during these time periods could result in increased stress to the elk produced by their being forced to use less desireable habitats where snow depths may be deeper and the quality and quantity of forage poorer. Such an increase in stress load during the most demanding period of the year can result in some direct winter mortality, particularly in calves and old elk, and a reduction in calf production and survival the following spring. It can also contribute to overuse of the winter forage resource on the remainder of the winter range onto which these elk would be displaced. If winter/spring forage becomes limiting or is of poor quality elk will turn to ranch hayfields where they are available. This alternative source of forage is available in this case along the Clark's Fork valley in Wyoming where hayfield depredation by this elk herd is already a problem, particularly during the late winter/early spring months (Roop 1988).

Although the drill site is not a major calving area, some cows remain there during the calving period (Stewart 1988; Van Dyke 1989) and could be displaced by the proposed action. Displacement of pregnant cows and cows with new calves would increase the potential for calf mortality. Since the period immediately following calf drop is critical to calf survival, the initiation of project construction activities in the late spring should be delayed until calves are old enough to travel with their cows without undue danger. According to Van Dyke (1989) and Stewart (1989) adequate protection to calves would be afforded if construction activities were initiated no earlier than June 15.

Based on the work of Brekke (1985) and Ward (1985), it is estimated that the proposed action will cause elk to exercise line-of-sight avoidance behavior which will displace them from an area of approximately 1-square mile on and around the well site. During years of normal climatological conditions drilling activities on the Ruby site, up through November 15, would displace elk from approximately 1 of the 23 square miles of available fall range (4.35%) and would be of little consequence because of (1) the relatively few numbers of animals on the project area during this time window, (2) the relative abundance of comparable alternative habitats during this season, and (3) the usually peak physical condition of animals during this time of year. However, during unusual fall seasons when abnormally dry conditions prevail, or when extremely deep snow depths occur unseasonably early, the habitat options of elk are greatly reduced and the animals are concentrated on lower elevation areas which include the proposed

drill site (Van Dyke 1989 and Stewart 1989). During such fall seasons, continued project activities on the well site after September 15 may cause significant impacts by displacing elk from a key area at a time when viable alternative habitats are in short supply and cows and calves need to add food reserves that are critical for winter survival (Van Dyke 1989 and Stewart 1989). Displacement of elk from the Ruby Creek area during such years would reduce their use of available fall habitats by approximately 10% by denying them the use of approximately 1 out of the 10 square miles of habitat available.

Because the drill site is on a prominent bench, equipment located there is highly visible throughout the drainage and is likely to contribute substantially to the development of avoidance behavior in elk (Lyon et al. 1985). If the drill rig is left on the site following cessation of drilling activities in the fall it is likely to continue to act as an displacement object to elk and may cause a continuation of their avoidance of the site and adjacent areas. Since Van Dyke (1989) has demonstrated that this site is an important part of fall elk range and is on a travel corridor used frequently by elk during the spring and fall it is important that major visual barriers be removed from the site during the period of fall, winter, and spring elk use of the area.

The displacement of one or several black bears from portions of their spring or summer habitats is not expected to create a significant impact on this species due to the availability of relatively large amounts of comparable, alternative seasonal habitats. During dry falls mesic habitats such as the Ruby Creek Draw become more important to both bears and elk and displacement would have greater impact. Because the potential for impacting spring/fall black bear use of the area is predicated on the same climatological and time constraints described above for elk, black bear use of the drill site and adjacent area is not likely to be impacted if these constraints are followed (Stewart 1989).

Since no significant impacts to the prey base of cougars in the area is anticipated, the proposed operation is not expected to adversely affect cougars. Van Dyke (1989) feels that, if firearms are prohibited on the drill sites, there will be no significant impacts to resident cougars as they can be expected to change their activity and behavior patterns so as to avoid contact with drilling operations.

Proposed project activities are not expected to impact the spotted bat, if present, in that the only human related activities that have been identified as being detrimental to this species are those which eliminate water near sedimentary cliffs or activities that destroy cliff faces and canyon walls (Snow 1974; Clark and Dorn 1981).

The probability of occurrence of the grizzly bear, wolverine, and North American lynx on the drill site is so remote that any impact to these species is very unlikely. Since no raptor nests are known to occur on or near the well site no impacts to these species are expected.

Alternative A - Access Route

Potential impacts to wildlife species are analyzed separately for each of the four access road segments previously described under the Affected Environment portion of the

wildlife section. Access road segments are numbered in chronological order proceeding from Montana State Highway 72 and progressing westward to the drill site (Exhibits D-3 and D-5).

Segment 1. Segment 1 consists of 5 miles of gravel-surfaced county road extending westward from State Highway 72 to its end in WSW34:T8S:R21E (Exhibit D-3). Considerations involved on Segment 1 include assessments of the potential for vehicular collisions with mule deer, sage grouse, Hungarian and chukar partridge, cottontail rabbits, skunks, raccoons, rodents, mountain plover, long-billed curlews, Swainson's hawk, bald and golden eagles, white-tailed prairie dogs, black-footed ferrets, and general wildlife.

Since no improvements to this road segment are proposed, no loss of wildlife habitats will occur. The principle potential impact of project-associated activities is an increase in the potential for vehicle-wildlife collisions, particularly for young birds and animals, birds which use the road as a source of grit or gravel, and slow- moving, inconspicuous, and nocturnal species such as skunks and rodents. Unless appropriate precautions are taken, an increase in vehicular collisions with the following species is likely: mule deer, sage grouse, Hungarian and chukar partridge, cottontail rabbits, skunks, rodents, and raccoons. Although no sightings of either the mountain plover or the long-billed curlew have been documented near this road segment, they are known to occur along the Clark's Fork river drainage in Wyoming a few miles south of the Montana/Wyoming border. It is possible that they also occur in the vicinity of this road segment.

Vehicular collisions with raptors is also a potential impact due to the fact that some species will land and feed on vehicle-killed fauna on the road and thereby expose themselves to the same fate. Both bald and golden eagles utilize this area and are known to scavenge vehicle-killed carrion. The status of the Swainson's hawk in this area is not known. Apparently suitable habitat and feeding grounds occur along this road segment, but no sightings have been documented (Flath 1988; Stewart 1988). Although the prairie dog colony just north of the road in Section 33:T8S:R22E (Table D-2; Exhibit D-7) may be too small in size to support black-footed ferrets, a remote possibility exists and appropriate precautions should be exercised.

The potential for vehicle-wildlife collisions is greatest in the early summer through the early fall months when young of the year are abundant and widely distributed. Collision potential is also higher during the hours of darkness when driver visibility is decreased and animals are blinded by headlights.

Segment 2. This access segment consists of 8 miles of unimproved roadway extending between the west end of the county road in SWSW34:T8S:R21E, and the eastern boundary of the Custer National Forest (Exhibit D-5). Considerations involved on Segment 2 include assessments of (1) the potential for vehicular collisions with white-tailed deer, mule deer, pronghorn, sage grouse, white-tailed jackrabbit, cottontail rabbit, small birds, rodents, bald and golden eagles, prairie falcon, white-tailed prairie dogs, black-footed ferrets, and general wildlife, and (2) the impacts associated with the physical loss of wildlife habitats caused by road improvement activities.

Approximately 18.4 acres of sagebrush scrub habitat adjacent to this road segment will be eliminated during road improvement operations. The loss of this amount of sagebrush scrub habitat is not considered to be significant for the following reasons: (1)

this habitat is not critical to any of the T or E or other high interest species in the area, (2) habitats immediately bordering roadways are generally less used by wildlife species than comparable habitats which are farther removed from roadways , and (3) the quantity of habitat removed is very small compared to the relatively large amount of undisturbed comparable habitat in the area.

As in Road Segment 1, the principle potential impact of project-associated activities along Road Segment 2 is an increase in the potential for vehicle-wildlife collisions. The detailed description of potential impacts presented in the previous section on Road Segment 1 applies equally to this section on Road Segment 2, but to a somewhat different component of species. Unless appropriate precautions are taken, an increase in vehicular collisions with the following species is likely: white-tailed deer, pronghorn, sage grouse, white-tailed jackrabbit, cottontail rabbit, small birds and rodents. Since this road segment bisects approximately 3.7 miles of potential sage grouse nesting habitat (Exhibit D-7), the probabilities of encountering this species on the road may be particularly high. Raptor species which utilize the area and may be vulnerable to vehicular collisions include both the bald and golden eagles. Although prairie falcons occur in the area they seldom feed on carrion and are, therefore, less likely to collide with vehicles. Impacts to nesting prairie falcons are not anticipated because of the distance (0.75 miles) of the access road from potential nest sites (Exhibit D-5).

The prairie dog density in this area is not high and the closest this road segment comes to any documented colony is 1.75 miles (Exhibit D-7). Although the probability of encountering a black-footed ferret is remote, appropriate precautions should be exercised.

Segment 3. This segment of access consists of 0.83 miles of two-track roadway extending between the eastern boundary of the national forest and the termination of this track in SWSW10:T9S:R20E (Exhibit D-5). Considerations involved on Segment 3 include assessments of potential impacts on wintering elk and mule deer, migrating, fall/rutting, and calving elk, spring/fall black bear use, and breeding and nesting habitats of Brewer's sparrow, northern oriole, yellow warbler, and blue grouse.

This segment of access bisects the habitats of the same wildlife species listed under Alternative A - Drill Site and the detailed description of potential impacts presented there applies equally to this analysis of Road Segment 3.

Approximately 2.2 acres of sagebrush scrub habitat, 0.7 acres of limber pine woodland, and 0.02 acres of riparian cottonwood/willow scrub habitat adjacent to this road segment will be eliminated during road construction operations. The loss of these amounts of habitat is not considered to be significant because the quantity of habitats removed is very small compared to the relatively large amounts of undisturbed comparable habitats in the area. No significant impacts to Brewer's sparrow, the northern oriole, or the yellow warbler are expected.

Segment 4. This segment of access consists of 0.31 miles of new road construction extending between the upper end, or termination of, the two-track access in SWSW10:T9S:R20E and the drill site in WNW15:T9S: R20E (Exhibit D-5). Considerations involved on Segment 4 include assessments of potential impacts on wintering elk and mule deer, migrating, fall/rutting, and calving elk, spring/fall black bear use, and breeding and nesting habitats of Brewer's sparrow, and blue grouse.

This entire segment traverses the limber pine habitat type and bisects the habitats of the same wildlife species listed under Alternative A - Drill Site, and the detailed description of potential impacts presented there applies equally to this analysis of Road Segment 4.

Approximately 1.5 acres of limber pine habitat adjacent to this road segment will be eliminated during road construction operations. The loss of this amount of habitat is not considered to be significant because the quantity of habitat removed is very small compared to the relatively large amount of undisturbed comparable habitat in the area. No significant impact to Brewer's sparrow is expected.

Alternative A Roading Variations

Levels of relative impacts to wildlife species associated with each of the Alternative A roading variations are shown in Table D-4. Although impact potentials between the variations tend to be similar, several noteworthy differences become apparent when the extremes are compared. However, since the rankings in Table D-4 have no universal values and different individuals might assign different values to the various species, no absolute summation of impacts is meaningful. The differences between the Alternative A road variations are not great and any route could be implemented in a manner that would reduce potential wildlife impacts to levels considered non-significant. A possible exception to this is Variation A-4 which traverses known habitats of the mountain plover and the long-billed curlew (Candidate 2 species for federal T & E listing). Seasonal operating constraints or re-routing of the road would be necessary in order to protect these species (Roop 1989). Rankings in the table are intended as abbreviated guidelines to illustrate those areas that would require mitigation efforts on the different Alternative A roading variations.

Alternative B - Drill Site

Considerations involved on the drill site include assessments of potential impacts on winter, spring/calving, and fall/rutting habitats of elk; early and late winter and spring/fall transition range of mule deer; spring/fall black bear habitats; breeding and nesting habitats of Brewer's sparrow and blue grouse; and general wildlife.

This drill site exhibits habitats of the same wildlife species as the Alternative A Drill Site and, with a few exceptions, the detailed description of potential impacts presented there applies equally to the Alternative B Drill Site. One exception involves the fact that elk tend to leave the Gold Creek site earlier in the fall and return to it later in the late winter/early spring than they do the Ruby Creek site (Stewart 1988 and Van Dyke 1988). Also, the Gold Creek site is not utilized as much as a direct travel lane as the Ruby site is (Van Dyke 1988). If winter drilling was performed, the magnitude of displacement of elk from the Alternative B site during the winter months would likely be smaller than from the Alternative A site. A second exception is that mule deer do not occur on the Gold Creek site year-round, as they do on the Ruby site, but use the area during the early and late winter, and during spring/fall migrations (Van Dyke 1989 and Stewart 1989). Although the drilling operation will probably cause a few deer to modify their activity patterns they are not likely to be displaced from the general area and no significant impacts are expected (Van Dyke 1989 and Stewart 1989).

Table D-4 Comparison of Wildlife Sensitivity Levels Between the Alternative A Access Route Variations.

Species	Alternative A Access Route Variation			
	A1	A2	A3	A4
White-Tailed Deer Habitat	Same	Most	Same	Montana/None Wyoming*
Mule Deer Habitat	Same	Same	None	None
Elk Habitat	Same	Same	Same	Same
Sage Grouse Nesting Habitat	3.7 mi	5.4 mi	3.7 mi	Montana/3.1 Wyoming*
Prairie Falcon Nesting Habitat	Same	Same	Same	Same
Mountain Plover/ Long-Billed Curlew Habitat	Low	Moderate	Moderate	High
Bald Eagle Winter Habitat	Low	Higher	Higher	Higher
Pronghorn Antelope Habitat	Moderate	Moderate	Least	Most
Black Bear Habitat	Same	Same	Same	Same
Proximity to Prairie Dog Colony	Low	Most	Most	Montana/Low Wyoming*
Potential For Vehicle Collision	14.1 mi	22.9 mi	13.2 mi	18.0 mi

* - Wyoming Status Unknown

A total of 3.0 acres of limber pine habitat, consisting mostly of sagebrush vegetation, will be temporarily eliminated during the construction of the well pad and the stockpiling of topsoil.

Alternative B - Access Route

Potential impacts to wildlife species are analyzed separately for each of the four access road segments previously described under the Affected Environment portion of the wildlife section. Access road segments are numbered in chronological order proceeding from Montana State Highway 72 and progressing westward to the drill site (Exhibits D-3 and D-5).

Segment 1. Segment 1 consists of 5 miles of gravel-surfaced county road extending westward from State Highway 72 to its end in WSW34:T8S:R21E and is identical to Road Segment 1 of the Alternative A Road Access (Exhibit D-3). Because the segments are identical, assessment considerations and potential impacts to wildlife are the same as those previously described in detail for Road Segment 1 under the section entitled Alternative A - Access Route.

Segment 2. This access segment consists of 5.33 miles of unimproved dirt and gravel roadway extending between the west end of the county road and the old Amoco drill site in Section 11:T9S:R20E. (Exhibit D-5). Considerations involved on Segment 2 include assessments of (1) the potential for vehicular collisions with white-tailed deer, mule deer, pronghorn, sage grouse, white-tailed jackrabbit, cottontail rabbit, small birds, rodents, bald and golden eagles, prairie falcon, white-tailed prairie dogs, black-footed ferrets, and general wildlife, and (2) the impacts associated with the physical loss of wildlife habitats caused by road improvement activities. The eastern 4.23 miles of this segment of access bisects sagebrush scrub habitat, while the western 1.1 miles traverses limber pine habitat, and crosses the riparian habitat of Gold Creek in one place.

The 4.23 mile segment of roadway which traverses sagebrush scrub bisects habitats of the same wildlife species as Segment 2 of the Alternative A Access Route and, with minor differences, the detailed description of potential impacts presented there applies equally to Segment 2 of the Alternative B Access Route described here. The minor differences involve the amounts of potential sage grouse nesting habitat bisected by the respective road segments, the amounts of sagebrush scrub eliminated by proposed road improvements, and distances to potential prairie falcon nesting habitat and the nearest sage grouse lek and white-tailed prairie dog colony.

This access parallels limestone cliffs in which prairie falcons are suspected to nest (Anderson 1989). Proposed road construction to this segment of access may or may not pose the potential for impacting nesting falcons. Whether or not an impact occurs depends on (1) whether or not the falcons are currently maintaining an active nest in these cliffs, (2) the location in the cliffs of such an active nest, and (3) the seasonal time schedule of road construction in the vicinity of the cliffs. If the location of the nest is far enough removed from the road construction, (e.g. in the north-facing cliffs or on the south end of the east-facing cliffs), no impact is likely. If an active nest is located in the south-facing cliffs or on the north end of the east-facing cliffs road construction may cause nest abandonment during the incubation and early-nestling phases of the nesting cycle (April-May). Regular road traffic is not, for several reasons, expected to

cause impacts. Firstly, because the road is north of and parallel to the top edge of the south-facing cliffs, and is not visible to birds that might be present on these cliffs, and secondly, is far enough removed from the east and north-facing cliffs to make disruption of nesting birds unlikely (Exhibit D-5).

Segment 2 of the Alternative A Access Route bisects 3.7 miles of potential sage grouse nesting habitat, would eliminate 18.4 acres of sagebrush scrub habitat, and passes within 0.6 miles of the nearest sage grouse lek and within 1.75 miles of the nearest prairie dog colony. Segment 2 of the Alternative B Access Route bisects no designated sage grouse nesting habitat, would eliminate 10.2 acres of sagebrush scrub habitat, and passes within 1.8 miles of the nearest sage grouse lek and within 2.8 miles of the nearest prairie dog colony (Exhibit D-7).

The 1.1-mile portion of this segment which traverses limber pine habitat bisects habitats of the same wildlife species listed under Alternative B - Drill Site and the detailed description of potential impacts presented there applies equally to Segment 2 of the Alternative B Access Route described here.

Approximately 10.2 acres of sagebrush scrub, 2.7 acres of limber pine, and 0.03 acres of riparian cottonwood/willow scrub habitats adjacent to this road segment will be eliminated during road construction operations. These reductions in habitats are not considered to be significant because the quantities of habitats removed are very small compared to the relatively large amounts of undisturbed comparable habitats in the area. No significant impacts to Brewer's sparrow, the northern oriole, or the yellow warbler are expected.

Segment 3. This segment of access consists of 0.40 miles of two-track roadway extending between the old Amoco drill site in Section 11:T9S:R20E and the eastern boundary of the national forest (Exhibit D-4). Considerations involved on Segment 3 include assessments of potential impacts on elk winter, transition, fall/rutting, and calving habitats, mule deer winter and transition habitats, spring/fall black bear habitats, and breeding and nesting habitats of Brewer's sparrow and blue grouse.

Since this entire 0.40-mile segment bisects habitats of the same wildlife species listed under Alternative B - Drill Site, the detailed description of potential impacts presented there applies equally to Segment 3 of the Alternative B Access Route described here. Approximately 2.2 acres of limber pine habitat adjacent to this road segment will be eliminated during new road construction operations. This reduction in habitat is not considered to be significant because the quantity of habitat removed is very small compared to the relatively large amount of undisturbed comparable habitat in the area. No significant impacts to Brewer's sparrow are expected.

Segment 4. This segment of access consists of 0.47 miles of two-track roadway, trail, and unroaded topography extending between the eastern boundary of the national forest and the Gold Creek Drill Site in SWNE10:T9S:R20E (Exhibit D-5; Table D-3). Considerations involved on Segment 4 include assessments of potential impacts on elk winter, transition, fall/rutting, and calving habitats, mule deer winter and transitions habitats, spring/fall black bear habitats, breeding and nesting habitats of Brewer's sparrow and blue grouse, and general wildlife.

Since this entire 0.47-mile segment traverses limber pine habitat and bisects habitats of the same wildlife species listed under Alternative B - Drill Site, the detailed description of potential impacts presented in that section applies equally to this section of roadway. Approximately 2.4 acres of limber pine habitat adjacent to this road segment will be eliminated during road construction operations. This reduction in limber pine habitat is not considered to be significant because of the relatively large amount of undisturbed comparable habitat in the area. No significant impact to Brewer's sparrow is expected.

Impacts Summary

Significant impacts, as previously defined in this section, could occur, but are avoidable and unlikely to happen if mitigation measures prescribed in this document are implemented. Significant impacts which, unless mitigated, could occur are listed as follows, in the order of their decreasing probability: (1) the displacement of elk from winter, spring, and fall ranges, (2) they displacement of black bears from spring/fall ranges, (3) an increase of more than 10% in the short-term direct mortality of wildlife species caused by collisions with motor vehicles, and (4) the death or injury of a federally-listed or candidate species of wildlife caused by a collision with a motor vehicle.

As detailed below, the probability for significant impacts to wildlife, and the intensity of such impacts, is generally greater under Alternative A than Alternative B. However, the application of prescribed mitigation measures would reduce impact potential and allow either of the proposed alternatives to be performed without the production of significant impacts to wildlife.

The Alternative B Drill Site is more peripheral to the main body of the elk winter range, is less used by elk during the winter, and is less of a travel corridor during seasonal elk movements than the Alternative A Drill Site. The visual impact of the drilling and construction activities, and its probable displacement effect on wintering elk, would be lower on the Alternative B Drill Site than on the Alternative A Drill Site because of differences between the two drill sites in topography, seasonal elk distribution and movement patterns, and distances from the core of the elk winter range.

More winter and transition range forage of elk (10.7 vs 9.8 acres) and more total acres of wildlife habitats (25.3 vs 20.3) would be eliminated in Alternative A than in Alternative B. The potential for road-killed wildlife is somewhat higher under Alternative A than Alternative B because the Alternative A access route traverses more total miles (14.14) and more miles of potential sage grouse nesting habitat (3.7 miles) than Alternative B, which traverses 11.2 and 0.0 miles, respectively.

As detailed in the Biological Evaluation (Appendix F of the DEIS), determinations of "no effect" were concluded for all Threatened, Endangered, and Candidate species listed for the project area.

Cumulative Impacts

Although both of the proposed drill sites are already relatively easily accessible via field vehicles, the improvement of access roads will increase the potential for use of the area by the general public. However, circumstances exist which will act to moderate this potential for greater use and include (1) the fact that the proposed access routes traverse gated private lands, and (2) the fact that vehicular access behind the forest boundary is currently prohibited and blocked by gates. Increase in use of the area by the general public is not expected to be of sufficient magnitude to significantly impact wildlife.

The performance of drilling and construction activities would increase the total proportion of the year during which Line Creek elk are exposed to human disturbances (e.g. hunting, snow machines, etc.). In the absence of appropriate mitigation measures, the addition of drill site disturbances to the displacement effects produced by the traditional fall hunting season are likely to be significant during unusual fall seasons when abnormally dry conditions prevail, or when snow depths are extreme unseasonably early. This additive effect would be the most pronounced during the early fall (September 15 - October 15). During this time frame bow hunters can be expected to move elk around within the Ruby drainage but are not likely to displace them from the entire drainage (Stewart 1989). During an active well-drilling operation, however, the elk would tend to avoid the drill site during daylight hours and alter their movements and activity patterns to stay out of sight of the operation through the use of topography, timber, or darkness as cover. During daylight hours elk would tend to avoid line-of-sight exposure to the drill site and construction activities by distances of up to 0.75 to 1.0 miles (Brekke 1985), and would likely be temporarily displaced from the respective Ruby Creek or Gold Creek drainage. Such a displacement would, during the September 15 - October 15 period of a climatologically abnormal fall season, produce a potentially significant negative effect on the elk by substantially reducing the amount of time they are able to utilize the forage on and adjacent to the drill sites, which are key areas during fall seasons which are abnormally dry or sustain unseasonably early and heavy snowfall (Van Dyke 1989).

Later in the fall (October 15 - November 15) the additive effect of drilling disturbances plus the displacement created by rifle hunting is likely to be quite different (Stewart 1989). When rifle hunters arrive in the vicinity of either of the drill sites the elk will have already been displaced from the entire drainage containing the well. However, the displaced elk will merely be in the places that the first few hours of rifle season would normally displace them to anyway (Stewart 1989). This cumulative or additive effect is not considered to be significant.

The increase in project-related traffic on the access route is likely to elevate the numbers of vehicle-killed and injured wildlife unless the precautions for minimizing vehicular collisions with wildlife described in Section 5.3.6 are exercised. Of particular importance would be measures to minimize the probability of collision with a federally listed threatened or endangered species such as the bald eagle.

When there is a substantial reduction in quality habitat options during the early fall season (September 15 - November 15) due to climatological events, such as drought, heavy snow fall, fire, etc., the increased displacement impact created by the addition of well-drilling activities to the existing bow hunting activities would likely have a

significant negative effect on elk unless the mitigation measures described in Section 5.3.6 are exercised. During a year of normal climatological events the performance of proposed activities on either of the alternative drill sites between June 15 and November 15 is not expected to have a significant impact on elk productivity or survivorship (Stewart 1989 and Van Dyke 1989).

Cumulative impacts associated with Field Development are described and discussed in detail in Appendix B. In general field development has the potential to negatively impact wildlife at a significant level. The principle impacts include substantial increases in the potential for (1) displacement of elk from fall, winter, and spring/calving ranges and black bears from spring/fall ranges, (2) vehicle collisions with a variety of wildlife species on access roads, (3) physical loss of wildlife habitats from road, drill site, production site, and pipeline construction, (4) displacement and mortality of raptors from powerline and drill site construction and operation, (5) displacement, injury, or mortality of federally listed and Candidate 2 species, and (6) loss or injury of wildlife due to accidental spill or discharge of petroleum or other chemical products. All of the potentially significant impacts associated with field development can be reduced to non-significant levels with the implementation of mitigative measures itemized in Appendix B.

Unavoidable Adverse Impacts

Unavoidable adverse impacts that would occur throughout the life of the project on either of the alternatives include (1) some increase in the potential for vehicle-related wildlife injuries, stress, and mortality, (2) loss of some wildlife habitat, and (3) the displacement of sensitive wildlife species from some habitats. The implementation of mitigation measures summarized previously would fully mitigate or reduce all significant impacts to levels not considered significant.

MITIGATION

The following mitigation measures are recommended in order to eliminate, or reduce to non-significant levels, the adverse impacts described previously in this report:

1. In order to minimize the probability of displacing elk from their seasonal transition, fall/rutting, winter, and calving habitats, project operations within designated elk habitats should be limited to the period extending between June 15 and November 15 during years of normal climatological events. During years of abnormal climatological events (drought, unseasonably early and heavy snow, extensive fire, etc.) drilling operations should be terminated on a designated date, between September 15 and November 15, when or if FS officials, in consultation with MDFWP biologists, determine that the continuation of operations beyond such date would have a significant negative impact on elk, according to the impact significance criteria defined in the front of the Environmental Consequences Section of this document.

2. In the event that drilling cannot be completed in a single operational period (June 15 - November 15), the rig should be dismantled and removed from the elk range. To avoid the possibility of elk developing a permanent or long-term

avoidance behavior towards the drill site, drilling activities should not continue through November 15 for more than two consecutive years.

3. Noise levels at the drill site should be maintained at low enough levels to minimize disruption and displacement of elk (A maximum dB level will be designated in the FEIS).

4. Road maintenance and construction work outside of designated elk habitats can be performed at any time without impacting elk.

5. In order to facilitate big game movements and minimize the potential for injuries, road access rights-of-way should not be fenced.

6. The potential for vehicle/wildlife collisions can be reduced substantially by requiring all drivers to undergo a training session describing the type of wildlife in the area that is susceptible to vehicular collisions, the circumstances under which such collisions are likely to occur, and the measures that can be employed to minimize them. The probability of animal/ vehicle collisions can be further reduced by imposing speed limits on access roads and prohibiting night travel. If night travel cannot be eliminated, speed limits should be further reduced during the hours of darkness.

7. Because black bears are common in the area, steps should be taken to minimize the possibility of attracting them and to avoid possible human/bear encounters. All personnel should be informed and educated regarding actions and circumstances that are likely to result in human/bear encounters and the measures that can be taken to minimize the potential for such encounters. The prescribed Interagency Grizzly Bear Guidelines for food handling and storage and the disposal of garbage should be followed so as to minimize the possibility of attracting bears. No dogs or firearms should be allowed on the drill site or project. Any bear problem should be reported promptly to biologists of the Montana Department of Fish, Wildlife, and Parks (MDFWP). The same climatological and time constraints, described previously in this section for elk, are equally applicable to black bears and should be exercised in order to avoid impacts to this species (Stewart 1989).

8. In order to reduce incidents of game law violation all project workers should be instructed on local wildlife regulations and state wildlife laws. Pertinent regulations should be posted in conspicuous places at the job sites. Personnel should also be instructed about the nature of the wildlife species which occur on the work site, potential impacts to these species and measures that can be taken to avoid or minimize impacts. Project workers should report bear sightings, raptor nests, and other noteworthy wildlife occurrences to the MDFWP.

9. In the event of a dry hole, the well site and adjacent disturbed habitat should be reclaimed to approximate pre-project levels for vegetative cover and physical condition. During reclamation a variety of forage species that are useful to resident herbivores should be established.

10. If Alternative B is selected a survey should be conducted to determine whether or not an active prairie falcon nest is present in the limestone cliffs adjacent to

Access Segment 2. If an active nest is found, it may be necessary, depending upon the location of the nest, to delay road construction activities until late into the young-rearing period (early June).

11. A helicopter survey of cliff habitats in the vicinity of the proposed well sites should be performed prior to commencement of drilling activities to determine whether or not peregrine falcons are nesting there. Survey procedures will be conducted under the direction of the FWS and MDFWP in strict compliance with their specifications. In the event nesting activities are found, the FWS and MDFWP must be consulted immediately and appropriate mitigative actions developed and implemented.

12. Prior to the commencement of construction and drilling activities, spring surveys to determine the occurrence and locations of previously unknown sage grouse leks and the nests of mountain plovers and long-billed curlews should be conducted along and adjacent to all of the Montana roading alternatives and variations. In the event that new leks or nests are found, appropriate mitigative actions must be developed, in consultation with the MDFWP and the FWS, and implemented.

13. In order to (1) maintain an on-going assessment of the effectiveness of prescribed mitigation measures, (2) obtain a specific measure of elk response to the proposed actions, and (3) develop a solid data base for use in possible future environmental assessments of field development it is recommended that the elk study currently being conducted by Dr. Fred Van Dyke be continued at least throughout the exploratory drilling phase of the project. When or if field development is undertaken, the study should be continued to monitor effects on elk.

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VISUAL RESOURCES

VISUAL RESOURCES TECHNICAL REPORT

Prepared For The

Ruby A Federal No. 1-9 Exploratory Oil/Gas Well Project

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VISUAL RESOURCES TECHNICAL REPORT

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Exhibit E-1. Areas of Visual Access to the Proposed Ruby A Federal No. 1-9 and Gold Creek Alternative Drill Sites and Access Roads on Forest System Lands E-4

VISUAL RESOURCES TECHNICAL REPORT

INTRODUCTION

Alternative A (Proposed Action) - Ruby Creek Drill Site and Access Route

Phillips proposes to directionally drill a 12,520-foot exploratory oil/gas well on the Beartooth Ranger District, Custer National Forest, Carbon County, Montana. The drilling proposal is located in the Ruby Creek drainage, a tributary to the Clarks Fork of the Yellowstone River. The drill site is located in the NW1/4 NW1/4 Sec 15, T9S, R20E. Access to the proposed site would utilize 4.3 miles of Montana State Highway 72 south from Belfry, Montana, to Grove Creek Road, an existing improved county road. From this point, access would head west towards the drill site, utilizing 5.0 miles of Grove Creek Road and approximately 8.0 miles of existing unimproved "two-track" roads to the Custer National Forest boundary (Forest boundary).

Access to the Forest boundary would traverse BLM-administered land and land under private ownership. From the Forest boundary, access would utilize approximately 0.8 miles of unimproved two-track road to its terminus. To reach the drill site from this point would require approximately 0.3 miles of new road construction. Phillips proposes to construct a 1.7-acre drill pad. Disturbance associated with this alternative would include 21.3 acres of existing road reconstruction (two-track), 1.5 acres of new road construction, a 1.7-acre drill pad, and 0.8 acres of cut and fill slopes and topsoil stockpile associated with the drill site. Total disturbance would be 25.3 acres.

Alternative A Access Route Variations

To assist in the FS and BLM decision-making process, three access route variations to the proposed drill site (Alternative A) were considered in the analysis of this alternative. The purpose of the analysis is to provide a contrast in management opportunities and environmental impacts that would assist the agencies in the decision-making process. These variations are summarized in the following sections.

Proposed Action (Variation A1)

This variation is Phillips' proposed access route to the Ruby Creek drill site described previously.

Meeteetse Trail - Robertson Draw Access Route (Variation A2)

The Meeteetse Trail - Robertson Draw Access Route variation follows the county improved Grove Creek Road to its terminus for 5.0 miles from Montana Highway 72. From the end of the Grove Creek Road, this access route follows unimproved two-track roads for approximately 1.1 miles to the Meeteetse Trail road and then follows this road for approximately 5.1 miles to its convergence with the Robertson Draw Road. From this point the access route follows the Robertson Draw Road for 5.7 miles to a point where an unimproved two-track road heads north toward Mill Draw. The access route follows this two-track road to Mill Draw where it converges with Phillips' proposed access route. From this point, this access route variation is identical to Phillips' proposed access route. This variation would involve 5.0 miles of the improved county Grove Creek Road requiring no reconstruction, 10.8 miles of improved county

road (Meeteetse Trail and Robertson Draw Road) requiring minor reconstruction, 6.8 miles of unimproved two-track road requiring major reconstruction, and 0.3 miles of new road construction.

Southern Access - Robertson Draw Access Route (Variation A3)

The Southern Access - Robertson Draw Access Route variation would originate from Montana Highway 72 approximately 2.2 miles north of the Wyoming border. The access route follows a county road for 1.5 miles across the Clarks Fork to the Robertson Draw Road. From this point access to the drill site would be identical to the Meeteetse Trail-Robertson Draw Access Route (Variation A2) described previously. This variation would involve 1.5 miles of county improved road requiring no reconstruction, reconstruction or new construction of the bridge over the Clarks Fork, 5.7 miles of improved county road (Robertson Draw Road) requiring minor reconstruction, 5.7 miles of unimproved two-track road requiring major reconstruction, and 0.3 miles of new road construction.

Clark Wyoming Access Route (Variation A4)

The Clark Wyoming access route variation originates from Wyoming Highway 120 approximately 8.6 miles south of the Montana border. From this point the access route follows an improved county road for approximately 2.0 miles towards Clark, Wyoming, to an intersection with county road 8WC where the route turns north along this road for 2.4 miles to the intersection with county road 8VC. The access route follows this road west for approximately 0.5 miles to an intersection with a graded dirt road heading north to the Joanne Ranch. The access route heads north on this route for 6.1 miles along unimproved two-track roads to the Robertson Draw Road where this access route converges with Variations A2 and A3 and then follows Variation A2 and A3 routes to the drill site. This variation would involve 7.6 miles of county improved road requiring no reconstruction, 10.1 miles of unimproved two-track road requiring major reconstruction, and 0.3 miles of new road construction.

Alternative B - Gold Creek Drill Site and Access Route

The Gold Creek drill site is located in the Gold Creek drainage in the SW1/4 NE1/4 Sec 10 T9S R20E. Access to this site would utilize the same route as described under the proposed action to the terminus of Grove Creek Road. From that point, access would head west utilizing existing unimproved two-track roads leading to Gold Creek for 5.3 miles to an abandoned drill site. An additional 0.9 miles of new road construction would be required to access the drill site from this point, of which 0.5 miles would occur on Forest land. A 2.2-acre drill pad would be constructed at the Gold Creek drill site. Disturbance associated with this alternative would include 12.9 acres of existing road reconstruction (two-track), 4.4 acres of new road construction, a 2.2-acre drill pad, and 0.8 acres of cut and fill slopes and topsoil stock pile associated with the drill site. Total disturbance would be 20.3 acres.

AFFECTED ENVIRONMENT

The project area is typical of the Middle Rocky Mountain Physiographic Province. The topography is steeply sloping, forming distinct microclimates with a resultant variability in vegetation cover types. The interspersed mosaic of vegetation communities results in a visually interesting and appealing landscape that would be classified as Common-Natural in character (See Appendix E-1 for definition of terms). The highest elevations occur along the western ridgeline that delimits the Line Creek Plateau. The ridgeline and east-facing slope are a continuous and dominant landscape element. The palisades just north of the proposed site, Meeteetse Spires, are regionally unique topographic landmarks. Due to their unique character and associated physical and biological attributes, the Meeteetse Spires have recently been proposed as a nature preserve as discussed previously (Lesica 1988).

Six distinct vegetation cover types were identified in the immediate project area and described in the Vegetation Resources Technical Report. These communities include sagebrush scrub, limber pine woodland, mixed conifer, alpine bunchgrass and forblands, riparian cottonwood and willow, and agricultural land. The mixed conifer stands dominate the upper elevations of north and east-facing slopes. In most locations there are distinct edges between conifer stands and lower growing forms of vegetation on south-facing slopes. Some open stands of limber pine, however, create visual transitions between pure conifer stands and the sagebrush scrub. Riparian vegetation associated with Gold Creek and Ruby Creek creates visually important lineal patterns in the landscape. The visual importance of these patterns is emphasized in the fall when the leaves turn color. Soil colors in the project area vary depending on location; however, a light brown to gray-buff soil color is most prevalent. Lighter colored soils are most prevalent on ridges and dark soils more typically associated with riparian areas.

Major access routes in the project area include Montana Highway 72, Grove Creek Road, Meeteetse Trail, and Robertson Draw Road. Face of the Mountain Trail (Trail #7) as shown on Exhibit E-1 passes close to both drill sites where observers would be in a superior (elevationally above) position. All other routes would place the viewer in a viewer-inferior position. Much of the dispersed area recreation (primarily hunting, but also including hiking and horseback riding along the Face of the Mountain Trail) occurs on sideslopes and ridges that are at the same elevation as or overlook the drill site. The Custer National Forest LRMP has placed the immediate project area within Management Area C. Visual Quality Objectives (VQO) for Management Area C ". . . will include Retention, Partial Retention and Modification" (USDA-FS 1986a). The plan does not make site-specific delineations of VQO zones; however, the Shoshone National Forest has delineated site-specific VQOs in the Shoshone National Forest Land and Resource Management Plan (USDA-FS 1986b) on lands similar in character just three miles to the south. The Shoshone National Forest 2A Management Area applied to sites similar in landscape character to the project area have been assigned a VQO of Partial Retention where "management activities are not evident or remain visually subordinate to the characteristic landscape" (USDA-FS 1986a). A Partial Retention VQO was deemed appropriate for the entire Management Area C (the affected environment), including the drill site, and was used in preparing this analysis.

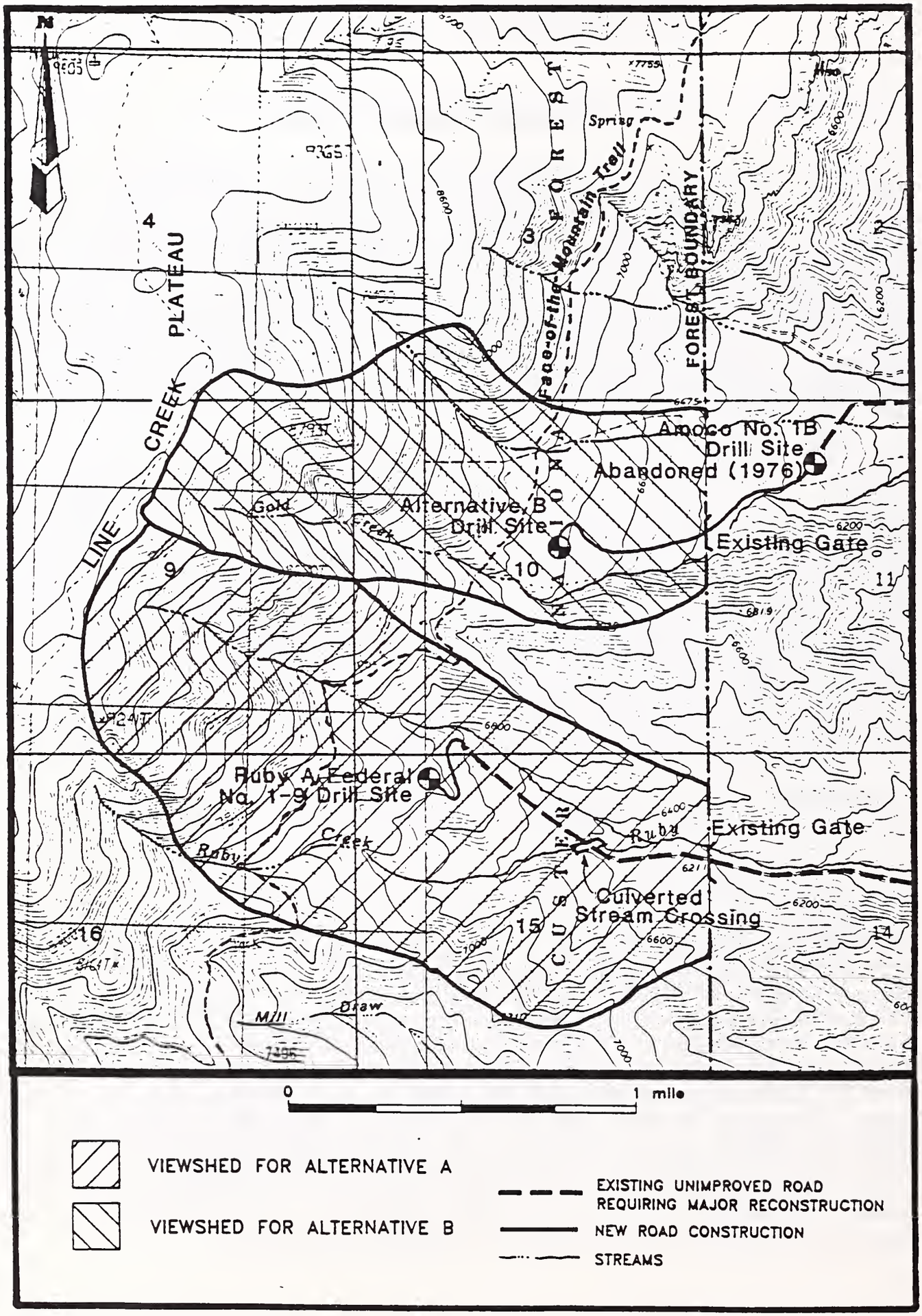

Exhibit E-1. Areas of Visual Access to the Proposed Ruby A Federal No. 1-9 and Gold Creek Alternative Drill Sites and Access Roads on Forest System Lands.

Alternative A - Proposed Action

Access Route

The Visual Absorption Capability (VAC), the ability of the landscape to absorb visual change, of the existing unimproved two-track roads along this access route is minimal; however, because of the low angle of slope, varied road alignment and diverse topography, the existing access route is not highly visible. The access route from the Forest boundary to the drill site traverses a sagebrush scrub and limber pine woodland punctuated with a narrow band of riparian vegetation along Ruby Creek at the lower elevations. Approximately 800 feet of new access road would cross a steep sideslope with a gradient ranging from 50 to 60 percent. The sideslope is oriented to the northeast, toward the primary viewer location. The slope is primarily covered by a relatively dense stand of limber pine and some Douglas-fir, with two sections each approximately 100 feet in length without tree screening. Tree height ranges between 20 to 25 feet with an average trunk spacing of 10 to 15 feet. The final 300-foot section to the drill pad crosses a flat bench vegetated with sagebrush scrub. Gray-green is the dominant color of vegetation, with dark green accents. Yellow fall color of riparian vegetation is evident at lower elevations. The VAC of this last section of road is moderate, with a few areas rated high, in some isolated locations with occasional breaks as noted above.

Three access route variations to the proposed drill site, in addition to the proposed access route, have been identified by the BLM and FS for consideration. The environment of these variations is very similar to the description presented earlier for the proposed access route (Variation A1). More people see the environment of access Variations A2, A3, and A4 than Variation A1 since the roads utilized for these variations are public and receive greater volumes of recreational traffic.

Drill Site

The drill site occurs on a small bench enclosed on the north, south and west by steep topography. Predominant vegetation is sagebrush, grasses and common juniper, with scattered individual limber pine and Douglas-fir. There are dense stands of mixed conifers both upslope and downslope from the site. The average height of these conifers is between 20 and 30 feet; average spacing between trunks within the stand is 10 to 15 feet. Landscape color is evenly split between gray-green and dark green. Soil color varies from light to dark brown. The VAC is moderate, with a few areas rated high for the following reasons: gently sloping pad area, mottled pattern of evergreen vegetation, enclosing topography, high trunk density, downslope evergreen screening and long distance from primary viewing areas.

The immediate viewshed, or the area surrounding the drill site that has visual access to the site, is approximately 970 acres in size as shown on Exhibit E-1 but continues for ten miles to the east and would be visible from Highway 72, Grove Creek Road, Robertson Draw Road, and the Meeteetse Trail, as well as from some local ranches. The Face of the Mountain Trail passes within approximately 600 feet west and slightly above the site and those using the trail would be able to see the drill pad (Exhibit E-1). Those who could view the site would include a small number of hikers, trail riders, hunters, ranchers and, potentially, motorists on Highway 72. The site would be within a Partial Retention VQO.

Alternative B - Gold Creek Site

Access Route

Access to this drill site from the improved county road to the abandoned Amoco drill site is similar to that described for Alternative A. From the abandoned Amoco drill site, the access route proceeds upslope at a grade that varies in a range from 15 to 25 percent. The first roughly 0.3 miles of road would follow an existing unimproved jeep trail. The trail closely parallels the riparian vegetation along Gold Creek. The riparian vegetation produces a highly visible line of contrasting color, particularly in the fall, that leads the eye of those viewing the mountain from lower elevations to the drill site area. The final section of road would depart the existing jeep trail and traverse the undulating land surface to the drill site. This section of the route would traverse sagebrush scrub with occasional scattered limber pine and Douglas-fir. These conifers are 10 to 15 feet in height on average. Large boulders dispersed in random fashion add a coarse texture to the landscape. Gray-green is the dominant color of vegetation, with dark green accents and a line of yellow fall color in the riparian area. Soil color is gray-brown. The slope the road ascends is pitched toward the primary viewer position. The VAC for the lower 0.5 miles of access route is moderate to high and moderate for the remaining 0.4 miles.

Drill Site

This drill site is located on a flat to undulating east facing slope with an approximate gradient of 20 percent. It is enclosed on the north, south, and west by steeply sloping topography. An open stand of limber pine, varying in height from 10 to 20 feet with an understory of sagebrush and grass comprise the dominant vegetation types. Average spacing between conifer trunks is 20 to 30 feet. Numerous large boulders cover the site and adjacent slopes. Gray-green is the dominant landscape color with dark green accents. The soil color is a light brown. The VAC for this site is moderate for similar reasons as listed under Alternative A. However, no areas are rated high because lower trunk density, shorter trees, lack of downslope screening, and a steep slope toward primary viewer positions combine to reduce the VAC rating here. The immediate viewshed is approximately 600 acres as shown on Exhibit E-1, but would continue for ten miles to the east. The drill site, located within a Partial Retention VQO, would be visible from the same transportation routes, including the Face of the Mountain Trail, as described under Alternative A.

ENVIRONMENTAL CONSEQUENCES

Introduction

Short-term visual impacts associated with construction of this proposal would include visual contrasts between the industrial character of the construction equipment, the drilling operation, and the characteristics of the undisturbed surrounding landscape. In addition, heavy volumes of truck traffic and fugitive dust could produce negative visual impacts beyond the immediate site. Both short-term and long-term impacts to the visual resource would be possible where patterns of area, line, form, color, and texture in the existing characteristic landscape would be visually contrasted by drilling equipment and/or construction-related damage to vegetation, topography or other visible

site features. The severity of impact depends upon the visual absorption capability and distance from the most sensitive viewing area, reclamation potential of the landscape disturbed, and the level of visual disturbance of the resource created by the proposed action. The duration of the impact would be a function of the time required to complete the action and the time required for the site to return to a predisturbance condition. In general, impacts would be most severe on sites where mitigation would be difficult and/or where visual contrast would be highly visible to potentially large numbers of viewers.

Impact Significance Criteria

The following criteria were used to determine the significance of impacts to visual resources due to the proposed action or alternatives. An impact would be considered significant under the following conditions:

- Where implementation of the proposed action or alternatives would violate forest wide management direction and/or management area direction as described and mandated by the Custer National Forest LRMP and EIS (USDA-FS 1986a) and the Billings Resource Area RMP (USDI-BLM 1983).

- Where alteration would occur to any characteristic landscape being managed under a Preservation Visual Quality Objective (VQO).

- Where alteration of the existing characteristic landscape would produce contrasts beyond the degree allowed for in a VQO, where contrasts would be visible to potentially large numbers of viewers and would appreciably diminish the aesthetic experience of these viewers.

- Where alteration of the existing characteristic landscape within any VQO would be severe enough that on-site mitigation would not bring the affected area into compliance with an acceptable degree of visual contrast for a VQO within the specified time period.

- Where changes created by the proposed action, in conjunction with other present actions, proposed future actions, and potential actions permitted under present management direction, that alter the overall character of the characteristic landscape from Scenic Natural to Man-Natural Mix, from Man-Natural Mix to Man-Dominated, from Common Natural to Man-Dominated, or from Common Natural to Man-Natural Mix, based on FS Visual Quality Objectives. (See Glossary for definitions.)

Direct and Indirect Impacts

Alternative A - Proposed Action

Access Route

Reconstruction of the access road across private property and BLM-administered land would increase the level of contrast already associated with the existing road; an

existing man-natural mix in landscape character. However, the road is not readily visible from most viewer locations, so the increase in contrast would not be considered significant. Improvements to the 0.8 miles of existing unimproved two-track road on Forest land would require removal of vegetation, cutting, and filling. The disturbance and increased road width would result in a more obvious contrasting line in the landscape. Topographic and vegetative screening would limit visual access to this section from most observer positions, the exception being Face of the Mountain Trail (Trail #7). Whether the impact would be considered significant from this trail and similar observer normal or superior viewer positions would depend on FS interpretation of the VQOs for Management Area C.

Approximately 800 feet of new road would be constructed across a steep sideslope. Construction activities would produce cut and fill slope exposing up to 25 vertical feet of bare soil. Much of the road would be screened from view, but two sections, each approximately 100 feet in length would be exposed to view. The contrast in form and color created by disturbance in these areas would exceed standards permitted under Partial Retention. With implementation of best management practices and mitigation, these impacts could be effectively reduced. No indirect impacts should occur.

The nature and extent of impacts for access road Variations A2, A3, and A4 would be similar to those described for Phillips' proposed access (A1). These variations are closer to Montana Highway 72, are close to several residences, and involve public county roads used by recreationists, such that the magnitude of impacts for these variations would be greater than for Variation A1. Variation A2 would potentially cause the greatest impact since this route involves both the Meeteetse Trail and Robertson Draw roads which are public roads. Variation A2 would involve 15.8 miles of public road while Variations A3 and A4 would involve 7.1 miles and 8.5 miles of public road, respectively. The experiences of recreationsists using the public roads could be affected due to increased truck traffic and dust which detract from the aesthetic qualities of the area. Thus, implementation of variation A2 could potentially cause the greatest magnitude of impact of the variations.

Drill Site

In the short-term, impacts to the visual resource associated with construction of the proposed drill site would be considered significant from all viewing points (See Exhibit E-1) because they would not meet a VQO of Retention, Partial Retention, or Modification; and would change the landscape character from Common Natural to Man-Dominated mix. Cut and fill slopes of 28 feet on a face pitched toward most primary viewer positions would result in changes in form, color, and texture that contrast markedly with the adjacent undisturbed landscape. The rectangular drill pad form is foreign to the characteristic landscape. In addition, the size, form, and possibly color of the 162-foot tall drill rig would extend well above screening vegetation and would dominate the immediate environment. The drilling rig would be visible from Highway 72, Grove Creek Road, Robertson Draw Road, Meeteetse Trail road, and the Face of the Mountain Trail and would dominate the foreground of this trail. Lighting of the drill rig tower would extend the visual impact into nighttime hours. The lights would be visible from a large area to the east of the project. The noise generated during drilling and construction activities could further degrade the aesthetics of the project area.

These impacts would persist for the duration of drilling activity. The fence that would be constructed around the drill site would not add to the visual impacts due to drilling activities since it would be screened from most viewer locations and would not add appreciably to the industrial nature of the drill site. Should the drilling process extend to a second season, the drill rig could potentially be stacked on-site during the late fall, winter, and spring period. Drill rig stacking compared to leaving the rig mast up would reduce visual impacts during this six-month period. If the rig could not be stacked on-site, then it would be stacked in Section 13 out of public view.

If producible quantities of oil and/or gas are not encountered, removal of the rig, reclamation of the pad to approximate original contour, and successful implementation of recommended mitigation procedures could bring the drill site up to a Partial Retention level in the long-term with landscape character changing from Man-Dominated Mix to Man-Natural Mix. However, if producible quantities were encountered, the cut and fill slopes of the new road would be secured for a two- to three-year interim period while additional environmental analysis (i.e., environmental assessment and/or environmental impact statement) was conducted and the FS and BLM reached a decision concerning well production and field development. Thus, impacts to the visual resource would remain during this interim period with a Man-Dominated Mix.

Alternative B - Gold Creek Site

Access Route

Reconstruction of existing access roads would be of a magnitude similar to those described for the proposed access. Construction of the final 0.9 miles from the abandoned Amoco drill site to the Alternative B drill site would require new road construction, including minor cutting and filling. Because of the large number of boulders in this section of landscape, the probability of windrows of boulders paralleling the road during the construction period is high. The result would be an increase in the level of line contrast. As with the proposed access, this access route could be brought into compliance with Partial Retention standards through successful implementation of recommended mitigation measures. No indirect impacts are anticipated.

Drill Site

Impacts associated with the construction and operation of this drill site would be similar to those described under Alternative A, with the following exceptions: cut slopes would reach 29 feet and fill slopes 33 feet and therefore, would be more visible. This site has a lower VAC, thus all visual contrasts created by the action would be more visible than at the proposed site (See Exhibit E-1).

Impacts Summary

The short-term impacts to the viewers in the project area associated with the construction of the drill pad and erection of the drill rig at either of the drill sites would be considered significant from most viewer positions (See Exhibit E-1) because they would exceed the level of contrast in line, form, and possibly color permitted in Retention, Partial Retention, or Modification zones. Impacts associated with the

alternative drill site would be most severe. Rig lights would be visible from a large area to the east of the project area including State Highway 72, Grove Creek Road, Meeteetse Trail, and Robertson Draw Road. Removal of the drill rig and application of recommended mitigation would bring the sites into compliance with Retention, Partial Retention, and Modification VQOs. Management direction, therefore, could be violated in the short-term but would not be violated in the long-term depending on FS interpretation of Management Area C VQOs.

The construction of access roads to either site would produce additional impacts to the visual resource. Widening of existing unimproved two-track roads and construction of new road on Forest lands would increase the level of line contrast in the existing landscape. The level of contrast would be considered significant from observer normal and superior viewer positions (See Exhibit E-1), particularly from the Face of the Mountain Trail, and could be considered significant depending on FS interpretation of Management Area C VQOs. Construction of access to the proposed site would cause more severe impacts than access to the alternative site. The project would not impact areas currently classified as Preservation.

Segments of areas affected by project implementation at Gold Creek would be visible from the proposed Meeteetse Spires Preserve from locations above 7,200 feet in elevation. The viewing distance from the southern boundary of the proposed preserve to the Gold Creek site is approximately 1.5 miles. Therefore, the preserve could be impacted in regard to visual aesthetics.

Cumulative Impacts

With the exception of the existing roads and abandoned Amoco drill site, there is little visual evidence of previous impact due to existing or past resource use or management. No new management activities that would affect the visual resource are planned in the immediate area. The landscape character type would be described as Common Natural. The proposed action, in conjunction with visual evidence of past action, would lower the overall visual character from Common Natural to Man-Natural Mix until mitigation measures have had sufficient time for revegetation to completely establish itself on all visible areas of disturbance. Once vegetation is re-established, the site would return to a Common Natural character type. Appendix B discusses impacts due to field development and indicates that cumulative impacts on the visual resource would be substantial.

Mitigation Summary

Access Roads

During construction, protect existing vegetative cover, trees and shrubs, in particular, at the edge of the right-of-way (ROW). Regrade and revegetate in the manner described in the Drill Sites section below; replace windrowed boulders as described below. To reduce the short-term adverse impacts associated with road construction, take steps to minimize fugitive dust.

Drill Sites

All permanent structures should be painted a flat, non-contrasting color that is harmonious with the adjacent landscape, except for structures that require safety coloration in accordance with Occupational Safety and Health Administration (OSHA) requirements. Maintain existing screening vegetation by minimizing the removal of trees and shrubs. After completion of well construction and drilling, recontour the pad to approximate original contours. Revegetate with indigenous or adapted species that match native plant community character and phenology. Planting should occur at the earliest suitable planting date. Replace boulders on the Alternative B drill site area in a pattern that reflects boulder arrangement in adjacent undisturbed areas. Remove all post-construction debris immediately after construction. Appendix D of the EIS presents a site-specific reclamation plan for the project.

Unavoidable Adverse Impacts

The significant short-term impacts to the visual resource associated with drilling activities are inherent in the operation and thus unavoidable. Removal of the drill rig and successful implementation of the recommended mitigation would reduce the high contrast between the disturbed area and the adjacent landscape, thus reducing visual impacts to levels not considered significant in the long term. If producible quantities of oil and gas were encountered, the visual impacts would remain during the interim two- to three-year period.

Comparative Analysis

The short-term impacts associated with construction of the drill pads and erection of the drill rig at the drill sites would be considered significant from most viewer positions due to contrasts in line, form, and possibly color that exceed levels prescribed by existing management direction for the area of interest contained in the Custer National Forest LRMP in the short term. Drill rig lights would be visible over a comparable area for both drill sites. Removal of the drill rig and application of recommended mitigation would bring the sites into compliance with the management direction. The construction of access roads would produce additional impacts to the visual resource. Widening of existing unimproved two-track roads and trails and construction of new road on Forest lands would increase the level of line contrast in the existing landscape. The level of contrast would be considered significant from viewer positions at or above the site of disturbance. Construction of access to Alternative A drill site would cause more severe impacts than access to the Alternative B site. Impacts associated with the Alternative B drill site would be more severe. Of the Alternative A route variations, Variation A1, Phillips' proposed access, would cause the least impact. The proposed project would violate existing management direction in the short term until reclamation is successfully achieved and the contrast in line, form, color, and texture meets visual quality objectives.

Irreversible and Irretrievable Commitment of Resources

The term irreversible commitment of resources describes the loss of future options. This primarily applies to the effects of using non-renewable resources (e.g., minerals or cultural resources) or to processes or factors (e.g., soil productivity) that are renewable only over long periods of time. The term irretrievable commitment of resources refers to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is irretrievably lost while an area serves as a winter sports site. The production lost is irretrievable, but the action is not irreversible; if use changes, timber production could resume.

No irreversible commitment of resources would occur to visual resources since project termination and reclamation would diminish visual impacts. Impacts to visual resources during project implementation would be irretrievable; however, the commitment would be minimal. Successful reclamation upon project termination would reverse the commitment.

MITIGATION AND MONITORING

The mitigation measures and monitoring requirements that follow will be included in the Conditions of Approval for the drilling proposal if project approval is granted. The measures and requirements were developed in response to impacts identified in the Environmental Consequences analysis and through issues identified during the scoping process. The measures and requirements describe how drilling will be managed to assure compliance with the resource management goals and objectives of the Custer National Forest Land and Resources Management Plan (USDA-FS 1986a), applicable lease stipulations, and resource limitations identified during interdisciplinary analysis. The following measures and requirements apply to Alternatives A and B unless otherwise noted. If deemed necessary in light of new facts or to minimize impacts, the following measures may be added to, modified, or selectively withheld. The Authorized Officer (AO) will determine final mitigation measures and monitoring requirements after consultation with the interdisciplinary team (IDT), who will have made recommendations based upon on-the-ground situation analysis.

General

- Implementation of the site-specific ERRP, as presented in Appendix D of the EIS, would greatly reduce impacts to visual resources.

Access Roads

- During construction, protect existing vegetative cover (trees and shrubs in particular) at the edge of the ROW. Regrade, revegetate, and replace windrowed boulders as described in Soils Mitigation and in Appendix D of the EIS.

- To reduce the short-term adverse impacts associated with road construction, take steps to minimize fugitive dust.

Drill Sites

- All permanent structures should be painted a flat, non-contrasting color that is harmonious with the adjacent landscape, except for structures which require safety coloration in accordance with Occupational Safety and Health Administration requirements.

- Maintain existing screening vegetation by minimizing the removal of trees and shrubs.

- After completion of well construction and drilling, recontour the pad to approximate original contours. Revegetate with indigenous or adapted species that match native plant community character and phenology. Planting should occur at the earliest suitable planting date.

- Replace boulders on the pad area in a pattern that reflects boulder arrangement in adjacent undisturbed areas per Appendix D of the EIS (Alternative B). Remove all post-construction debris immediately after construction.

FIELD DEVELOPMENT

Well Development

Phillips proposes to drill the Ruby A Federal No. 1-9 Prospect to determine the presence of hydrocarbon reserves and evaluate the commercial potential of the reserves, if encountered, by conducting various tests. These tests would include analyzing drill cutting samples to detect evidence of oil, drill stem tests to determine more closely the performance of the hydrocarbon reservoir's productive capacity, and electrical log surveys to determine reservoir porosity and presence of oil and/or gas. Depending on the outcome of the testing program, Phillips may choose to permanently plug the well and abandon and reclaim the location, temporarily plug or shut-in the well until decisions are reached regarding future production options, or request approval to enter production operations.

The decision to be made by Phillips regarding production from this one exploratory well is related to the amount/type of production encountered and the economic feasibility of producing that product from one well. This determination would be made after all well testing activities are completed and thoroughly analyzed by Phillips. If the decision is made to produce this well, there would be an interim period of no activity at the drill site when Phillips is attempting to obtain a permit to produce from this one exploratory well.

The following discussion describes activities associated with producing this one proposed exploratory well.

Oil Well Development

If the well is an oil producer, several steps would be taken to test, complete, or develop the well. These steps would occur on the well pad and normally include the following

actions: installation and cementing of well casing; perforation of the reservoir; installation of production tubing; and installation of control heads (an assembly of valves and gauges called a "Christmas Tree") to regulate the rate of flow from flowing wells, or the installation of a pumping unit or other lifting mechanism to lift oil to the surface in a non-flowing well. Equipment off-site would include installation of a battery of tanks for storing the oil and installation of equipment to separate oil, gas, and water so that the oil meets sales requirements. Segments of the drill pad not needed for production operations would be regraded, topsoiled, and revegetated as per a comprehensive reclamation plan developed by Phillips and approved by the FS/BLM. Cut and fill slopes associated with drill pad construction would be revegetated. The access road to the drill pad and production facilities would remain in place for maintenance and production development purposes.

Initially, if hydrocarbons were encountered, production from the well would be stored at the production facility in tanks and trucked to market facilities. The number of trucks per day would be commensurate with the rate of production encountered. Production operations would require use and maintenance of an access road from the production facility to Montana State Highway 72 on a year-long basis. Maintenance during the summer and early fall months would be typical of graveled road maintenance in the area. Maintenance during the winter months would be relative to the amount of production encountered. Winter maintenance would include blading or plowing snow from the access road in a manner prescribed in a plan of operations prepared by Phillips and approved by the FS/BLM.

Gas Well Development

Much of natural gas production is associated gas produced with oil. As a result, natural gas production is influenced by oil well development and production practices. There are, however, certain features of gas well development that are specific to gas production. Reservoir pressure is the controlling factor in the ability of a gas well to produce. Estimating the reserves and forecasting production rates and production life are early considerations in determining the economic feasibility of gas well completion and development. Completion of a gas well includes steps comparable to that of an oil well. Casing, tubing, and well head equipment are selected on the basis of flow rates, fluid erosion, and chemical corrosion. Safety shutoff equipment is more critical and must meet higher design standards. Compressors may be needed to help the gas enter the pipeline if the well producing pressure at the surface is less than pipeline pressure. In either case, safety and flow regulator valves are installed at the well head. The equipment and fittings must meet standards set by the American Petroleum Institute (API) following sizes and ratings established by the American National Standards Institute (ANSI) if corrosive conditions are expected.

Based on what Phillips knows of the geology of the area, their targeted formations described in the APD, and the negligible quantities of gas encountered during previous drilling attempts by other companies in the area, Phillips does not expect to encounter gas during the drilling of this exploratory well. If non-producible quantities of gas are encountered (i.e., not economical to produce), with producible quantities of oil, the gas would likely be flared or vented off as authorized by an approved venting or flaring permit issued by the BLM.

Field Development

Oil and/or gas field development generally requires more than one well to efficiently extract the hydrocarbon reservoirs. Well density and location are designed to efficiently extract the oil/gas reserves based on specific reservoir characteristics, economics, and environmental considerations. Most of the information required to determine appropriate well density and locations is not available until after the reservoir has been penetrated and production characteristics have been established during the exploratory phase. After considering all pertinent information, the well density would be subject to the approval of the State of Montana Oil and Gas Conservation Board and the BLM.

The following discussion regarding development of the Ruby A Federal No. 1-9 Prospect is based on what Phillips currently knows of the geology of the Ruby area from seismic interpretations and established well control data from fields to the northeast and southeast of the prospect area.

Only after exploratory drilling would more complete information regarding the geologic structures of interest be known. Once this geologic information is gained, more concrete determinations regarding the intensity and extent of field development would be made by Phillips. If oil or gas is present in commercial quantities, wells would be completed and production equipment and facilities installed. Development activity might be limited to drilling, plugging, and reclaiming the current drilling proposal or extended to drilling numerous wells from three well sites, with their attendant tank batteries, electric lines, and access roads.

The three proposed well sites are located such that Phillips should be able to reach and develop 80 percent of the leasehold. Because of the structures being drilled and drill site vertical and horizontal displacement limitations, all three well sites would be located on the Custer National Forest. Directionally drilling the Ruby Prospect requires a high vertical elevation location and a limited horizontal distance to the downhole drilling target. The higher elevation allows the vertical space needed to achieve changes in direction for the drill bit. The horizontal distance from the wellbore to the target must be as short as possible to minimize the angle needed to reach the target. Phillips estimates that moving off-Forest would limit the potential development of these leases to less than 30 percent using conventional directional drilling methods.

Aspects of field development as currently envisioned by Phillips include the following:

- Confirmation Well - If the initial exploratory well encountered hydrocarbons (either gas or oil), an additional exploratory well, called a confirmation well, would likely be drilled to confirm the findings. This well would be drilled from a drill site location approved through the NEPA process. The confirmation well would be directionally drilled to test the extent of the geologic structure in another direction. This well would also help evaluate the hydrocarbon potential of the structure.

- Production Wells - The steep topography of the east face of the Line Creek Plateau and the perceived location of the geologic structure limits the number of suitable well site locations available for field development. As a result, as many wells as feasible would be drilled from each of the three well sites. Phillips estimates that a maximum of six directional production wells could be drilled

from each well site, for a maximum of 18 producing wells within the field. Phillips would attempt to complete one production well annually on each of the well sites, for total well development in six years. This estimate assumes few drilling and completion problems. Phillips estimates a range of six to ten years or longer to complete the wells, with allowance for drilling and completion problems. The actual number of wells that could be expected from each well site would be better known following evaluation of the original test well and the confirmation well. Each well site would be equipped with one well head for each producing well and surface piping as needed to operate the method of well pumping utilized. Phillips currently plans to use hydraulic well pumps. These pumps were selected because they are unobtrusive, quiet, and operate on produced oil.

- Production Facilities - One off-site production facility is anticipated for each well site and would be located up to three miles from the well site. Phillips has proposed off-site production facilities to reduce the frequency of required visits to each well site for monitoring and maintenance purposes. Well visits for servicing operations would occur weekly during the winter and spring months. During the summer and fall months, wells could be visited more frequently. The use of automatic shutdown systems and well control from the remote production facilities would preclude the need for daily visits. Well sites would be accessed from the production facilities by enclosed motor vehicle during the winter months. Access roads to the production facilities and the producing well sites would remain open year-round.

  The production facilities would require electrical power, continual access, and numerous pieces of production equipment as described above. Electricity would be brought in to the production facilities either from the north or south by tying into existing power sources. Likely powerline corridors from existing power sources to the production facilities would follow the transportation systems. Power poles and line configurations would be designed to reduce impacts to raptors. Electricity would be located underground from the production facilities to the well pads.

  Phillips plans to install all flowlines, power oil/lift gas, instrument gas, electricity, and heating lines underground in the access road corridor, as needed, from the well sites to the production facilities to operate equipment at the well sites remotely. The number, size, and use of these lines would be determined by the characteristics of the hydrocarbon being produced. Characteristics and behavior of the hydrocarbon reservoir may make necessary changes from one production method to another over the life of the field.

- Pipeline/Transportation - Pipelines for fluids from the wells to the production facilities would be laid within the existing road right-of-way. Pipeline routes utilized from the production facilities to a tie-in with existing pipeline(s) would depend on the product destination (i.e., the purchaser of the product). There are several existing underground pipelines that could be utilized. These pipelines include three Husky lines (2-inch, 3.5-inch, and 4-inch), an Amoco 12-inch line, and a Marathon Oil 6-inch line. These lines are located approximately 12 to 15 miles to the east of the Ruby A Federal No. 1-9 field and generally parallel Wyoming Highway 120 and Montana Highway 72.

Crude oil from the production facilities would be transported to market by pipeline if the volumes produced are large enough to justify the expense of laying the lines. If this justification cannot be made, crude oil would be hauled from the production facilities by tanker trucks and transported to a truck unloading depot where the crude oil would be unloaded into a pipeline leading to a larger interstate pipeline. Production amounts would be monitored by means of a Lease Automated Custody Transfer unit (LACT), or hand gauging.

Pipeline construction would occur in a planned sequence of operations common to oil/gas pipeline installation specifications and would take place along a corridor of continuous activity. All pipeline installation work would be completed by a contractor working under Phillips supervision. An average 50-foot width of disturbance is anticipated.

The actual pipeline location would be surveyed and staked prior to start of construction activities. The pipeline corridor would be cleared of heavy brush prior to earth-disturbing activities. Topsoil would be stripped starting from the center of the corridor, or center line of the trench, and windrowed along the outside edges of the right-of-way (ROW). The route would be graded as necessary for passage of construction equipment.

Subsoil would be removed and stockpiled separately from topsoil. The ditch would be excavated mechanically with ditching equipment. The width of the ditch would vary depending on the size of pipe being laid. For example, the ditch width would be 14 inches for a 4-inch-diameter pipe and 18 inches for a 6-inch-diameter pipe. The ditch would be of sufficient depth to permit a minimum cover of 36 inches over the pipe.

Pipe-laying activities would include pipe stringing, bending, welding, coating, lowering of pipeline sections, and backfilling. Special construction measures would be utilized where pipelines cross stream channels. Subsoil would be backfilled into the trench over the pipe. Site regrading would occur where necessary. Topsoil would be evenly spread over the disturbed area to a maximum depth of six inches, and reclamation of the pipeline route would occur as authorized by the BLM and the fee-surface owner.

Natural gas, if produced in sufficient quantities, would be transported by pipeline. The procedure utilized in transporting natural gas by pipeline is similar to that described for oil. As previously mentioned, based on what Phillips knows of the geology of the area, their targeted formations described in the APD, and the negligible quantities of gas encountered during previous drilling attempts by other companies in the area, Phillips does not expect to encounter gas during the drilling of this exploratory well. If non-producible quantities of gas are encountered with producible quantities of oil, the gas would be flared or vented as authorized by an approved venting or flaring permit issued by the BLM.

o Safety Systems - Because of the remoteness and sensitivity of the project area and operational timing constraints, safety shutdown systems would be included in the production facilities and well sites. Automatic shutdown systems would be used to assure that the wells cease operations when the flowline pressure is too high or low or if the well itself experiences an operations problem. The

production facilities would also be operated with shutdown systems to control tank fillage. If for some reason tank space is limited, the wells would be shut in by high level controllers in the tanks. Automatic shutdown systems using a variety of technologies are available. The system used could include electronic equipment requiring electricity at the well pad, spring and pressure activated systems that do not require electricity, or a combination of the two. The well heads would be equipped with surface safety valves. Flowlines would be equipped with high- and low-pressure shutdowns. The tank battery facilities would be equipped with high- and low-pressure shutdowns on the pumps and high-level shutdowns on tankage. Secondary containment for all tankage would also be provided by a berm around the batteries and/or facilities site.

The impacts associated with the new well site and access road would be similar to those described for Alternatives A and B in the project EIS. However, if the proposed six separate wells were simultaneously drilled from each of the three drill sites with each drilling requiring one year, the drilling rigs could be in place (during the drilling season) for about six to ten years, depending on drilling problems encountered. The short-term impacts described for Alternative A would become long-term impacts under a field development scenario and would visually impact three miles of the face of the Line Creek Plateau for the duration of the drilling activity.

Site-specific locations have been proposed for the three storage tank batteries, with their tentative locations being adjacent to existing roads. There appears to be sufficient topographic diversity at each of the three sites to adequately screen the tanks from view. If selected sites are elevated and exposed, the visual impact would be more pronounced. Powerlines to each of the three storage batteries would increase the visual impact by adding foreign vertical elements to the characteristic landscape.

Short-term visual impacts associated with field development activities would include visual contrasts between the industrial character of the construction equipment, the drilling operation, and the characteristic landscape. In addition, heavy volumes of truck traffic and fugitive dust could produce negative visual impacts beyond the immediate site. Long-term visual impacts could be associated with the industrial nature of production facilities in contrast to the natural landscape. Both short-term and long-term impacts to the visual resource would be possible where patterns of area, line, form, color, and texture in the existing characteristic landscape would be visually contrasted by drilling equipment and/or construction-related damage to vegetation, topography or other visible site features. The severity of impact depends upon the reclamation potential of the landscape disturbed and the level of visual disturbance created by the proposed action. The duration of the impact would be a function of the time required to complete the action and the time required for the site to return to a predisturbance condition. In general, impacts would be most severe on sites where mitigation would be difficult and/or where visual contrast would be highly visible to potentially large numbers of viewers.

Pipelines are typically constructed in straight alignments regardless of topography and vegetation. The resulting lineal pattern can contrast with undisturbed landscape. The visual impacts are most pronounced in areas where the pipeline would not be constructed within access road ROW or where the proposed route crosses steep topography, crosses areas of dense and uniform vegetation, and/or where screening vegetation is minimal.

Site-specific evaluation of all proposed site disturbances is recommended for adequate prescription of specific mitigation measures. The following general mitigation measures are recommended:

- Well Sites: To minimize short-term adverse visual impacts associated with production drilling activities, maintain existing site-screening vegetation by removing as few trees and large shrubs as possible. Minimize site disturbance in general. After completion of well construction and drilling operations, recontour segments of the well site not needed for production and revegetate to minimize long-term impacts. All permanent equipment and structures should be painted a non-reflective color that blends with the surrounding colors and tones of the native environment.

- Access Roads and Pipelines: To reduce the short-term adverse impacts associated with road construction, take steps to minimize fugitive dust. During construction, protect existing vegetative cover at the edge of the ROW. Revegetate cut and fill sections on all access roads with indigenous species or adapted species that match native plant community character and phenology. Planting should occur at the earliest suitable planting date. The same recommendation applies to revegetation of all ROWs. Remove all post-construction debris immediately after construction.

- Locate production facilities in topographically low positions to minimize visual access. All permanent equipment and structures should be painted a non-reflective color that blends with the surrounding colors and tones of the native environment.

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APPENDIX

Visual Resource Definitions

Visual Resource Definitions

Distance Zones:

The visual effects of a given management activity on a user clearly decreases as the distance between the user and the activity increases. In order to quantify this effect, three distance zones from the viewer are defined. They are:

- Foreground 0-1/2 mile
- Middleground1/2-4 miles
- Background 4-10 miles

Sensitivity Levels:

Sensitivity levels provide a relative measure of a landscape's aesthetic importance or value from the standpoint of location and visual exposure to the public, whether they are recreationists, local residents, ranchers, forest product workers, or Forest Service personnel. It is recognized that all National Forest land is seen at some time at least by aircraft users. Therefore, some degree of visitor sensitivity is established for the entire land base.

Three sensitivity levels are used. Each one identifies a different level of visual exposure. They are:

- Level 1 - Highest
- Level 2 - Average
- Level 3 - Lowest

Variety Class:

The inherent scenic quality of the land making up the Bridger-Teton is, for planning purposes, equated with landscape variety. Any area of this land is allocated to one of the three variety classes. This determines those landscapes which are most important and those which are of lesser value from the standpoint of scenic quality.

The classification is based on the premise that all landscapes have some value, but those with the most variety or diversity have the greatest potential for high scenic value. There are three variety classes which identify the scenic quality of the natural landscape.

- Class A - Distinctive
  Refers to those areas where landforms and rock formations, vegetative patterns and water features are of unusual or outstanding visual quality.

- Class B - Common
  Refers to those areas where features do contain variety in form, line, color, and/or texture but to a degree that tends to be common throughout the area. The features are not outstanding in visual quality.

- Class C - Minimal
  Refers to those areas whose features have little change in form, line, color, and/or texture. This class includes all areas that do not fit into Classes A or B.

Visual Absorption Capacity:

Visual Absorption Capacity is a measure of the relative ability of the land to absorb visual change.

Visual Quality Levels:

Visual Quality Levels represent measurable standards for the visual management of the Forest. These standards are a result of combining the inherent scenic quality (Variety Classes) and the landscape's aesthetic importance (Sensitivity Levels).

- P - Preservation
  This visual quality objective allows ecological change only. Management activities except for low visual impact recreation facilities are prohibited.

- R - Retention
  This visual quality objective provides for management activities which are not visually evident.

- PR - Partial Retention
  Management activities remain visually subordinate to the characteristic landscape when managed according to the partial retention visual quality objectives.

- M - Modification
  Under the modification visual quality objective, management activities may visually dominate the original characteristic landscape. However, activities of vegetative and landform alteration must borrow from naturally-established form, line, color or texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding area or character type. Additional parts of these activities such as structures, roads, slash, root wads, etc., must remain visually subordinate to the proposed composition.

- MM - Maximum Modification
  Management activities of vegetative and landform alteration may dominate the characteristic landscape. However, when viewed as background, the visual characteristics must be those of natural occurrences within the surrounding area or character type. When viewed as foreground or middleground, they may not appear to completely borrow from naturally established form, line, color, or texture. Alterations may also be out of scale or obtain detail which is incongruent with natural occurrences as seen in foreground or middleground.

These levels are derived from the values established in the Variety Classes and Sensitivity Levels. Except for Preservation, each describes a different degree of acceptable alteration of the natural landscape. The degree of alteration due to management activities is measured in terms of visual contrast with the surrounding landscape that is generated by introduced changes in form, line, color or texture.

Overall Character:

- Man-Natural Mix to Man-Dominated
  Where moderate levels of scenic quality (partial retention and modification) are lowered in quality to modification and/or maximum modification.

- Scenic Natural to Man-Dominated
  Where high levels of scenic quality (preservation or retention) are lowered in quality to the partial retention objective.

- Common Natural to Man-Dominated
  Where moderate levels of scenic quality which appear undisturbed by human activity (retention, partial retention, or modification, Common variety classes) are lowered in quality to modification or maximum modification because of the visible nature of the man-induced mix.

- Common Natural to Man-Natural Mix
  Where moderate levels of scenic quality which appear undisturbed by human activity (retention, partial retention, or modification, Common variety classes) are lowered in class to modification because of the visible nature of the man-induced disturbance.

RECREATION

RECREATION RESOURCES TECHNICAL REPORT

Prepared For The

Ruby A Federal No. 1-9 Exploratory Oil/Gas Well Project

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RECREATION RESOURCES TECHNICAL REPORT

AFFECTED ENVIRONMENT

Introduction

This technical report addresses the potential recreation impacts of a proposed Phillips Petroleum exploratory oil/gas well in the Ruby Creek drainage in Carbon County, Montana. The report is intended to supplement material presented in the Draft Environmental Impact Assessment for the Ruby A Federal No. 1-9 Exploratory Oil/Gas Well, scheduled for release in May, 1989.

The proposed exploratory oil/gas well site is located in the Beartooth Ranger District of the Custer National Forest. The Beartooth Ranger District receives the highest level of recreation use of any Ranger District on the Custer National Forest (USDA-FS 1987). Available estimates indicate that approximately 550,000 Recreation Visitor Days (RVDs) of recreation use occurs in the Beartooth Unit each year (USDA-FS 1985); one RVD represents 12 visitor hours whether that is comprised of one person recreating for 12 hours or 12 people recreating for one hour each. This represents over 68 percent of the total recreation use estimated for the entire Custer National Forest in 1983 (USDA-FS 1986c).

This area of the Custer National Forest encompasses the Beartooth Mountains, which provide highly diverse recreation opportunities, including developed camping and picnicking, pristine wilderness areas, stream and lake fishing, hunting, hiking, mountain bike riding, horseback riding, nature observation and photography, skiing, and other activities in both developed and dispersed recreation settings. The accessibility of Yellowstone National Park to the southwest and the proximity of Billings, Montana, the state's largest population center, also contribute to the high level of recreation use that occurs in this general area.

Much of the recreation use in the Beartooth Unit is concentrated along the Beartooth Highway (Route 212), which provides highway access to Yellowstone National Park from Red Lodge. The FS maintains seven developed campgrounds in the Rock Creek Valley adjacent to the highway which attract considerable recreation use during the summer months. In addition, dispersed recreation use is concentrated in the area to the west of the highway where there are several trails providing access into the Absaroka-Beartooth Wilderness (USDI-BLM 1986). Substantially lower levels of use occur on the Line Creek Plateau, a large roadless area lying to the east of the highway that attracts low to moderate levels of hunting, hiking, backpacking, and other dispersed recreation activities. This high elevation plateau was included as an area designated for further study in the Montana Wilderness Bill that was vetoed by President Reagan in November 1988.

Most of the recreation use in this unit of the Forest involves residents of surrounding counties in Montana. FS estimates indicate that approximately 75 percent of users come from a local three-county area of Stillwater, Yellowstone and Carbon counties. Survey data collected by members of the recreation assessment team from 61 recreationists using areas along the Beartooth Highway during the July 4th weekend (1988) indicated that nearly 80 percent of campground users, 60 percent of backcountry

hikers, and 41 percent of motorists stopping at highway overlooks were from the Billings area; an additional one-third of backcountry users were from the Red Lodge area.

Analysis Area

The analysis area used to evaluate potential recreation impacts for both the proposed and alternative drill sites incorporates surrounding Forest lands that exhibit similar topographic and recreation use characteristics. The western boundary of the analysis area used for the current project is the extreme eastern edge of the Line Creek Plateau, approximately 1.0 mile to the west of the drill site locations. The eastern boundary of the formal analysis area is the National Forest Boundary, although the analysis also considers in a less site-specific manner potential impacts in an area to the east of this boundary where privately-owned lands and public land administered by the BLM are interspersed (USDI-BLM 1983). The southern boundary of the analysis area is the ridgeline on the south side of Robertson Draw, approximately 2.5 miles south of the proposed drill site. The northern boundary of the analysis area is the ridgeline on the south side of the South Fork of Grove Creek, approximately 3 miles north of the proposed drill site. This analysis area therefore comprises an area of approximately 4,920 acres lying between the plateau rim on the west, the Forest boundary on the east, and major drainages to the north and south.

One useful set of guidelines for analyzing potential recreation effects of a project such as the proposed exploratory oil well is the Recreation Opportunity Spectrum (ROS) classification system. This system has been adopted by the Forest Service for identifying the recreation potential of Forest lands and to guide management of recreation resources. Both the proposed drill site/access route and the alternative site near Gold Creek lie entirely within an area designated as providing Semi-Primitive Motorized recreation opportunities, which characteristically provide low-to-moderate frequency of contact with others and moderate levels of human alteration of the natural setting (USDA-FS 1986c).

Neither the current ROS designation or the management guidelines set forth in the Custer National Forest Land and Resource Management Plan (LRMP) prohibit the use of motorized vehicles or equipment in this area. However, for the past several years all Forest roads and other lands in this area, with the exception of Robertson Draw Road, have been closed to unauthorized motorized use on a year-round basis. Consequently, the recreation opportunities presently available near the proposed and alternative drill locations do not include use of off-road vehicles, snowmobiles, or other motorized recreation activities, and therefore tend to exhibit characteristics that are more consistent with the Semi-Primitive Non-Motorized (SPNM) designation in the ROS system than the current SPM designation.

In general, recreation use of this analysis area is quite low and well below the capacity of the area to provide dispersed recreation opportunities. Estimates used for planning purposes by the Custer National Forest report 0.49 RVDs per acre per year for this area (Logan 1988). However, that estimate reflects District-wide average use and was not adequately adjusted to represent the substantially lower use in this area. Unlike the highly accessible areas adjoining the Beartooth Highway, this section of the Forest is less accessible and has fewer features that attract recreation users. The nearby

Grove Creek Limestone Palisades are very scenic and provide an attractant to motorized recreationists using the Meeteetse Trail road. There is opportunity for dispersed recreation along the Meeteetse Trail road and along the Face-of-the-Mountain Trail which traverses the Line Creek Plateau face; however, very little overnight use is made of this area outside of the hunting seasons. The project area does not provide opportunities for stream and lake fishing, or other features that attract heavy use in other sections of the Beartooth Unit. Field observations by the study team during the otherwise busy July 4 holiday weekend indicated that this area was attracting very little recreation use. Individuals and groups using the area are more likely to be local residents rather than visitors from Billings or other non-local areas.

Alternative A (Ruby Creek) -- Recreation Setting

The proposed drill site is approximately 0.75 mile west of the Forest boundary. The eastern rim of the Line Creek Plateau lies approximately one mile to the west of and 2,000 feet higher than the drill site. The nearest boundary of the Absaroka-Beartooth Wilderness lies approximately 7.5 miles to the west of the drill site; the Beartooth Highway comprises a major highway corridor separating the wilderness area from the Line Creek Plateau and the project analysis area.

The proposed drill site and access route are in a section of the Forest that receives relatively little recreation use during most periods of the year. The existing unimproved road that would be used to approach the drill site provides potential access for recreation use of the area; however, the road is fairly rough in some sections, and sections within the Forest boundary are closed to unauthorized motorized use . Moreover, much of the road segment lying east of the Forest boundary crosses private land and is not open to unrestricted public use, although currently area land owners generally do not prohibit use of the existing roads. The nearest public road access to the Forest is at Robertson Draw, over two miles to the south, or at the North Fork of Grove Creek, over three miles to the north. Consequently, recreation use of the area is limited to persons who use foot and horse trails and those who are able to obtain permission to travel the road or who illegally trespass. Nevertheless, this road does provide access for some users, including the owners of a seasonal cabin located immediately adjacent to the road on private land just east of the Forest boundary.

With the exception of this privately-owned residence, there are no developed recreation sites or facilities in the area surrounding either the proposed drill site or access route. The Face of the Mountain Trail, which traverses the Beartooth Face from north to south, lies several hundred yards upslope from (west of) the proposed drill site. This trail represents the eastern boundary of the RARE-II study area comprising the Line Creek Plateau. The trail generally receives light use by hikers, horseback riders, and perhaps some mountain bike riders during the summer months and is also used by hunters during the fall.

Most recreation use of the area surrounding the proposed drill site and access route occurs in the fall during the various big game hunting seasons. Relatively modest hunting use occurs on Forest lands and on BLM and private lands to the east during upland game seasons, as well as during deer and antelope seasons. A very small

number of permits for mountain goats and bighorn sheep are also issued for the general area including the drill site, although the areas hunted tend to be in substantially higher terrain to the west.

The area is an especially popular location for elk hunters during both the archery and rifle seasons. The archery season for elk, which ran from September 3 through October 16 in 1988, is an either-sex hunt that is not restricted by a quota on the number of licenses available. In addition to use by unguided hunters, several local residents indicated that the area attracts limited outfitter use (Fears 1988; Henke 1988). At present, one outfitter who operates primarily during the elk archery season has been permitted by the FS to hunt in this general area. This outfitter maintains a base camp near Corral Creek approximately four miles northwest of the drill site, and also maintains a holding corral on the east side of the road in Seely Creek in the Rock Creek drainage. That outfitter has indicated some use of spike camps to keep hunters in the Ruby Creek area for several days at a time, and stated that in an average year approximately one-half of his clients will hunt in that area at some time during the season (Harrington 1988). FS records indicate that this outfitter is not permitted to establish spike camps in the project area on Forest lands. His client totals are relatively low, involving a reported 48 service days (4 clients) in 1987 and 88 service days (11 clients) in 1988 (Jaquith 1989).

Rifle season elk hunting is restricted by quotas on the number of licenses issued; in 1988 a total of 150 bull permits and 55 antlerless permits were available during seasons running between October 23 and November 27 for Hunting Districts 520-04, 520-05 and 520-06 (MDFWP 1988). These elk hunting districts include the analysis area, but also encompass a substantially larger surrounding area. One area resident reports that he guides an average of two or three hunters in this general hunting district unit during the rifle season (Chatlin, 1988). However, FS records indicate that no commercial hunting guides have been permitted to operate on Forest lands in this area, other than the one archery season outfitter noted previously. Consequently, elk hunters using the analysis area during the rifle seasons are unguided.

Winter recreation use of the area is quite low. Forest regulations prohibiting motorized vehicles preclude the use of snowmobiles, although some limited snowmobile use may occur on BLM and private lands to the east. Cross-country skiing use is also reportedly quite low. Some limited winter hunting activity occurs in the general vicinity during the mountain lion season (Harrington 1988). Spring recreation use is also is quite limited although spring bear hunting activity does occur in the area (Jaquith 1988; Henke 1988).

Summer recreation use is generally low, involving limited amounts of hiking, horseback riding, dispersed camping, nature observation and photography, mountain biking, and other dispersed recreation activities. Much of this use occurring near to the drill site and access route involves the Face of the Mountain Trail, which is used by some organized trail ride groups as well as individuals and private parties. The small creeks in the vicinity of the drill site and access route do not provide fishing opportunities.

In addition to the proposed access route, three access route variations to the proposed drill site have been identified by the BLM and FS for consideration. These routes are described in detail in the Transportation section of the Draft EIS. Roads that would be

utilized under Variations A2, A3 and A4, including the Meeteetse Trail and the Robertson Draw Road, provide recreationists with public access to the Forest as well as access to off-Forest dispersed recreation settings.

Alternative B (Gold Creek) -- Recreation Setting

The recreation resources available in the area surrounding the alternative drill site and access route are very similar to those described for the proposed drill site, although more stringent restrictions on the use of existing roads by private land owners appears to limit public access to a greater extent than at the Ruby Creek site. The drill site is only about 0.5 miles west of the Forest boundary, 1.0 miles east of the rim of the Line Creek Plateau and about 7.5 miles east of the nearest boundary of the Beartooth-Absaroka Wilderness. Use of this area is similarly restricted by the closure of Forest lands to motorized travel and the presence of privately-owned lands to the east that limit public access to the area. The Face of the Mountain Trail lies within a few hundred yards of the drill site, and attracts a variety of dispersed recreation uses during the summer and during the fall hunting seasons.

Most recreation use of this area also occurs in conjunction with hunting during the fall, primarily during the elk archery and rifle seasons. Levels of elk hunting use in this location may be slightly lower than in the area surrounding the proposed drill site, particularly with respect to outfitter use during the archery season (Harrington 1988).

ENVIRONMENTAL CONSEQUENCES

Introduction

Petroleum exploration and development activities of the type proposed by Phillips could impact the recreation activities and opportunities now present in the study area. Although recreational use of the project area is low, some recreational activities could be altered or displaced as a result of project activities such as drill site construction, well drilling, road construction, road use, equipment noise, or visual intrusions. Project activities may result in a deterioration of recreation opportunities and experiences even when displacement of recreationists does not occur. Such changes may lead to corresponding declines in the levels of satisfaction that users derive from participating in recreation activities in the area.

Previous analyses of petroleum exploration proposals in the Beartooth District have documented public concerns regarding recreation resource effects of such projects, particularly effects on hunting opportunities (USDA-FS 1985). Also, comments provided by members of the public during the scoping process focused specifically on concerns about the effects of project activities on recreation. These areas of concern are addressed in the following discussion of potential recreation impacts that could result from the alternatives under consideration.

Impact Significance Criteria

The following criteria were used to evaluate the potential significance of recreation impacts. The intensity of potential impacts on recreation resources varies in part as a function of the duration of project activities. In general, project impacts that are identified using these impact significance criteria but that would persist for no more than one year or one season of use are considered insignificant.

- The presence of project activities and facilities that would alter recreation opportunities, as represented by a revision of Recreation Opportunity Spectrum (ROS) area designations within a recreation analysis area encompassing the drill site, access route, and surrounding Forest lands, as follows:

    1. A greater than ten percent reduction in the amount of acreage designated as providing Primitive (P) recreation opportunities.

    2. A greater than 15 percent reduction in the amount of acreage designated as providing Semi-Primitive Non-Motorized (SPNM) recreation opportunities.

    3. A greater than 20 percent reduction in the amount of acreage designated as providing Semi-Primitive Motorized (SPM) recreation opportunities.

- A deterioration of the quality of recreation experiences or a reduction in the level of recreation use due to one or more of the following:

    1. Decreased populations of game or fish species.

    2. Levels or patterns of project activity that would displace or disrupt existing private or commercial recreation uses.

    3. Increased levels of human activity that would reduce recreationists' perceived levels of isolation or solitude.

    4. Construction of project-related facilities or roads within 200 feet of either side of the centerline of any and all designated trails.

Direct and Indirect Impacts -- Alternative A (Ruby Creek)

Drilling activities associated with this alternative would result in moderate changes in the recreation opportunities and qualities that are presently available in the area surrounding the proposed access route and drill site. The Semi-Primitive Non-Motorized (SPNM) (summer) designation for recreational opportunities on the Line Creek Plateau to the west would not be affected because the drill site is more than 0.5 mile from the rim of the plateau. Moreover, both the distance from the drill site and the effects of steep terrain and elevation differences would result in a topographic screening effect that would prevent most recreationists on the plateau from seeing or hearing any project activities as discussed in the Visual Resources Technical Report and as indicated on Exhibit F-1.

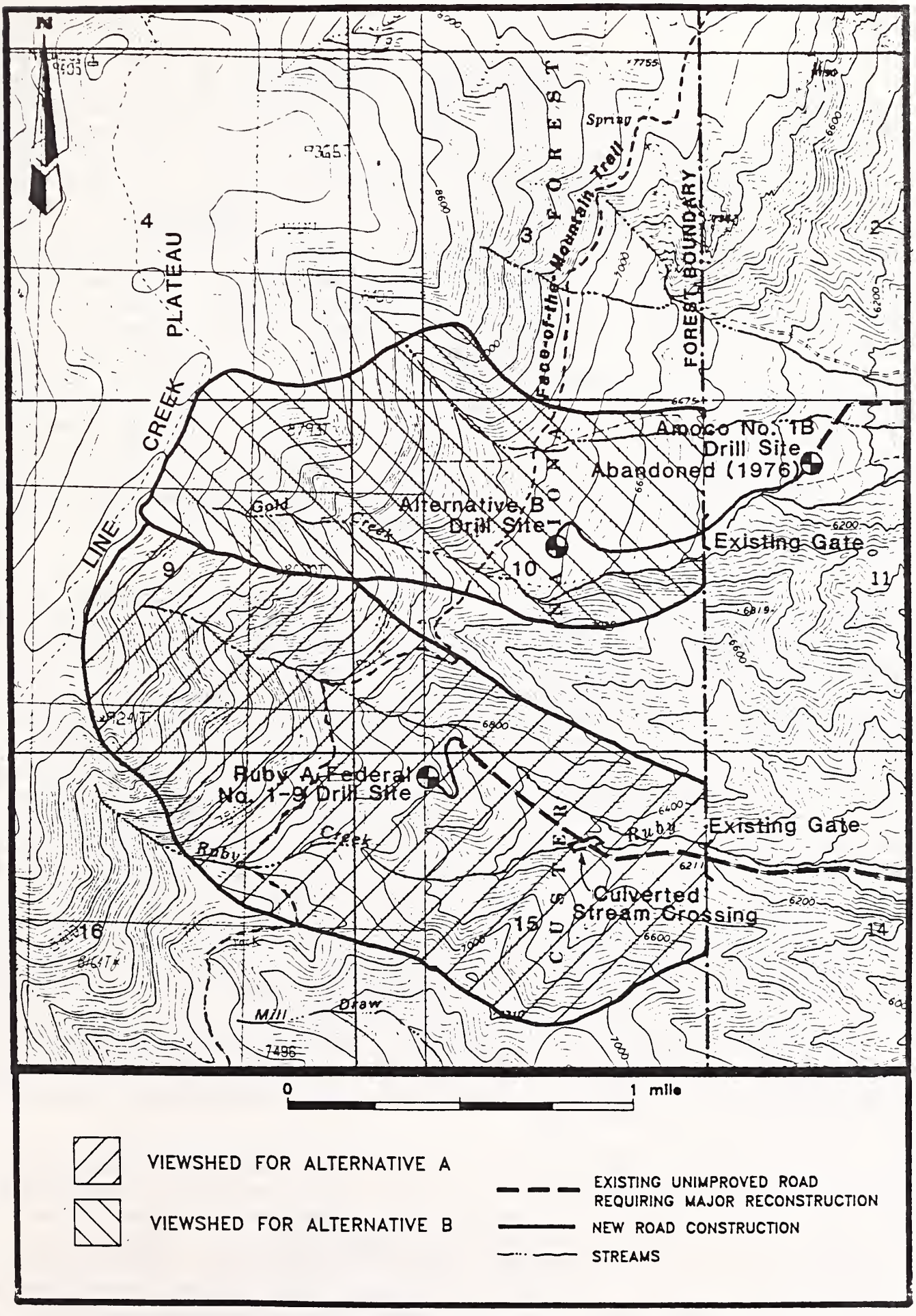

Exhibit F-1. Areas of Visual Access to Alternative A and Alternative B Drill Sites and Access Routes.

The current Semi-Primitive Motorized (SPM) designation for the area surrounding the drill site itself, however, would be inconsistent with the level of project activity and the extensive use of motorized equipment that would occur. A strict interpretation of the ROS guidelines suggests that these activities would sufficiently alter the recreation setting to necessitate a redesignation of approximately 490 acres surrounding the project facilities from SPM to Roaded Natural (RN), as indicated in EIS Exhibit F-2. This would be substantially less than 20 percent of the SPM acreage in the analysis area, and would therefore not represent a significant impact. Moreover, unless subsequent field development were to occur, this change in ROS conditions would be of relatively short duration and would therefore be unlikely to require a formal redesignation of the ROS classification for the affected area. Any inconsistency with the existing ROS designation would persist only until the completion of reclamation activities, at which time conditions in the area would again be consistent with the SPM designation that is presently applied to the analysis area. However, it is possible that the site would not be reclaimed for a period of two to three years between the completion of exploratory drilling and a decision regarding field development should producible quantities of oil and/or gas be encountered. For that period the recreation opportunities available in the area would continue to be negatively impacted, but at a lower level than during construction and drilling since little if any activity would occur at the drill site.

During the period required for road construction and exploratory drilling, recreational experiences and activities that occur in the immediate vicinity of the drill pad and access road could be displaced into other nearby areas as a result of construction and operating activities. The dust, fumes, and visual alterations associated with drilling, road construction, and other project-related equipment use could force the relocation of some recreationists from a larger surrounding area, and a reduction in the quality of recreation experiences for others. Project noise could cause a deterioration of the recreation experiences of users in an even broader area surrounding the drill site and access route. However, the low number of recreationists using the project area would limit the extent of such effects, and most users could relocate their activities to suitable alternative recreation sites elsewhere on the Beartooth Face that are at least as accessible. The low number of hikers and others using the Face of the Mountain Trail (Trail #7) would be exposed to visual and noise effects of the project while using trail sections within a mile or so of the drill site. Off-Forest motorized recreation activities on the Meeteetse Trail and other public roads could be affected slightly by the presence of crossing project traffic under roading Variations A1 and A4, and more substantially by project vehicle use of sections of these public roads under roading Variations A2 and A3. Overall, the low number of users and the localized nature of most effects suggest that such impacts would be minor, even if the exploratory activity lasts for two or three seasons. Minor improvement of the Meeteetse Trail under Variation A2 or minor improvement of the Robertson Draw Road under Variation A3 could facilitate recreational travel on these roads.

Short-term impacts on hunting would occur during the exploratory drilling period. The planned period of site occupancy would require drilling activities to end by November 15, well after the beginning of hunting in early September. Consequently, there would be some conflict between the drilling activity and fall hunting. Drilling activity would continue during the entire elk archery season and during most of the rifle season. The one commercial outfitter who guides elk hunters in the project area during archery season would be inconvenienced by the project, but could continue to use other areas

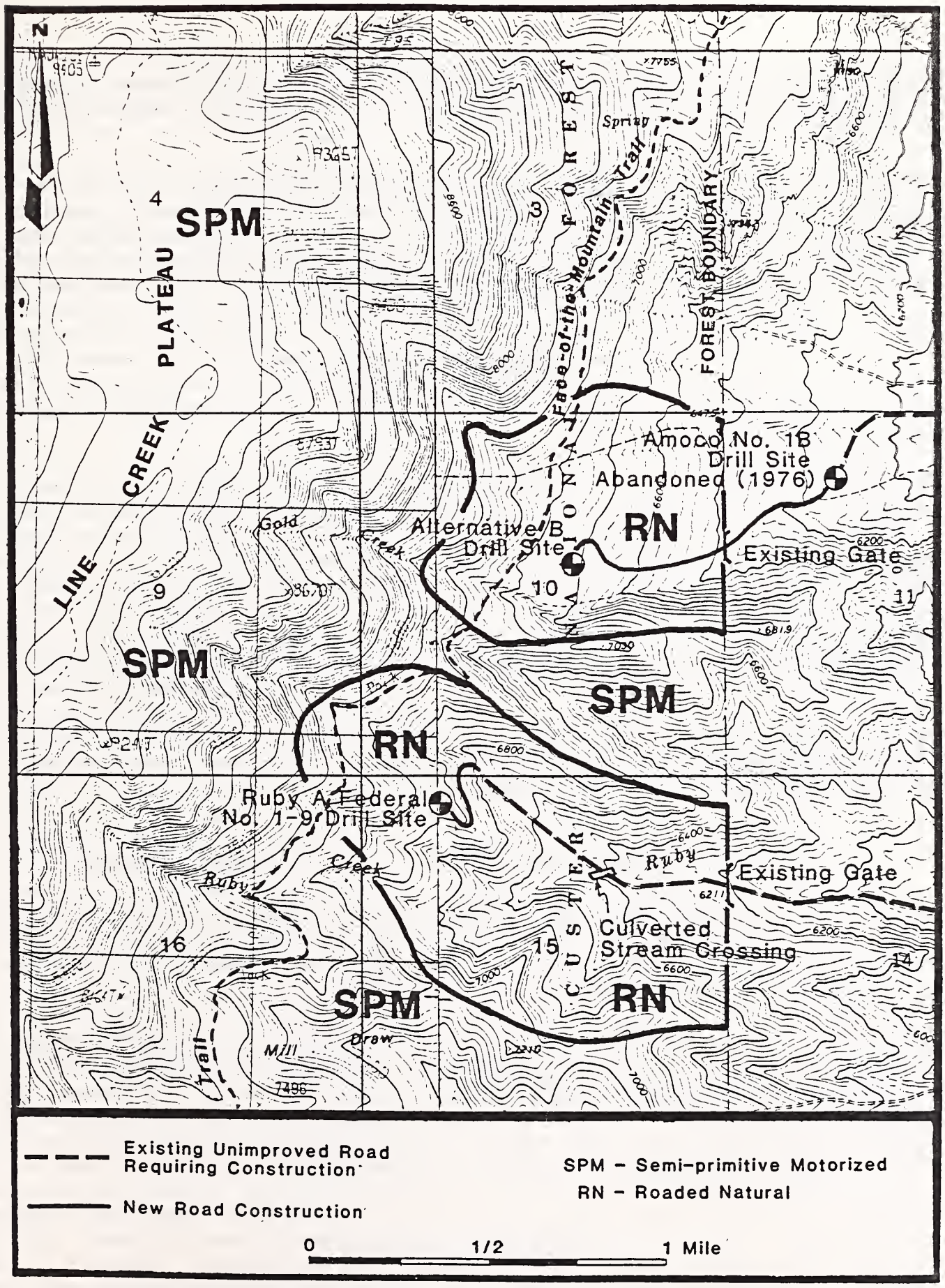

Exhibit F-2. Redesignation of Recreation Opportunity Spectrum Classes Due to Implementation of Alternative A and B Drill Sites and Access Routes.

along the face of the Line Creek Plateau as well as higher ground nearer to the top of the plateau. Project activities would not begin until late spring or early summer after the period when spring bear hunting occurs.

The overall effects of exploratory activities would involve inconvenience for some hunters, and would contribute to a deterioration of the quality dimensions of the hunting experiences available in the area. As a result, increased dissatisfaction would probably emerge among hunters accustomed to using this area. However, the absence of significant adverse effects on big game populations (see the Wildlife analysis in the EIS), and the ability of hunters to redistribute themselves into areas not immediately adjacent to the project site, suggests that the impacts of exploratory drilling activities on hunting recreation would be minor, even if the exploratory drilling carried over into a second or third project season. If project activities coincided with only one hunting season, impacts involving displacement of hunters and deterioration of recreation experiences would be insignificant.

None of the roading variations described in detail in the Transportation section of the EIS would result in provision of unrestricted public access to the Forest boundary or onto Forest lands, at least during the period of project activity. Therefore, the four roading variations considered for access to the proposed drill site would not differ in terms of impacts on recreation resources within the National Forest. However, off-Forest impacts on recreation would differ across the access route variations. Route Variation A1 would have the least impact on recreation, since it would primarily involve a road corridor that is not presently available for unrestricted public use. In contrast, the A2 route variation would conflict with public recreation uses of the Meeteetse Trail road, and the A3 and A4 route variations would contribute to conflicts between project vehicle traffic and public use of the Robertson Draw Road. The A4 route variation would also involve project vehicle use of some public roads in the extreme southern segments of that route.

Direct and Indirect Impacts -- Alternative B (Gold Creek)

Recreation impacts associated with the Gold Creek drill site would be very similar to those related to the proposed action. In general, the magnitude of effects would be somewhat lower at this site, since the drill site facilities and access road would not be as far within the Forest boundary.

The location of the drill site would not be inconsistent with the existing ROS classification of SPNM (summer) on the Line Creek Plateau to the west, due to the distance and topographic screening effects which separate the drill site area from the edge of the plateau. Exploratory drilling activity and access road construction, however, would be inconsistent with the current SPM classification of the project area itself. Approximately 277 acres would need to be reclassified from SPM to RN to be entirely consistent with the FS ROS guidelines (see Exhibit F-2). This is less than the amount of change required for the proposed drill site and represents an insignificant change in the recreation opportunity characteristics of the analysis area. Moreover, this ROS reclassification would probably not be required for a short-term exploratory drilling program. In the event the drill site is not placed into production (e.g., unless field development takes place) the area would return to a condition consistent with the SPM classification following site reclamation.

As with the proposed site, exploratory activities at this site could displace limited numbers of recreationists and cause a deterioration of recreation experiences for others. Hikers and others using the Face of the Mountain Trail would see and hear project activities while on trail segments in the area. Most users, however, could readily relocate to alternative recreation areas nearby. Impacts on hunting would not be as substantial at this site as at the Ruby Creek site, due to the somewhat lower levels of hunting use reported for this project location. Although hunter satisfaction would likely deteriorate somewhat, the ability of hunters to be redistributed into surrounding areas and the temporary nature of exploratory activities suggest that impacts on hunting use would be minor, even if the drilling continues into a second or third season.

Impacts Summary

The analysis presented above indicates that recreation impacts associated with exploratory activities at either the proposed site or the alternative drill site would be relatively minor. Changes in the recreation opportunity characteristics of both sites would be limited and would involve insignificant shifts in ROS conditions. Short-term displacement of limited numbers of recreationists would occur at both sites, as would a deterioration of the recreation experiences available to others who would continue to use the surrounding areas. These impacts, however, would involve relatively few people. The seasonal period designated for drilling activities would interfere with big game hunting, which is the primary recreation use occurring in both locations. However, hunters could generally relocate into nearby areas, and although some hunter dissatisfaction would be likely to emerge, such effects would be of limited duration for an exploratory drilling program.

The magnitude of negative effects would be slightly smaller at the Gold Creek site. This is due to the slightly lower hunting activity reported for that location and the smaller number of acres that would be affected by activities inconsistent with the current ROS classification. Also, drilling at the Ruby Creek site would involve road development and project traffic that could interfere with recreational use of the seasonal residence located near the Forest boundary, although the current owner of that cabin has indicated that he is not opposed to the proposed developments. No recreational or other residences are located near to the Gold Creek site.

In addition, the Gold Creek site may provide a slightly more favorable location for enhanced public access to the Forest that would be consistent with objectives for improved road access set forth in the LRMP, which calls for access to the Forest boundary at approximately five-mile intervals (USDA-FS 1986c). At present, area land owners have not denied public access to the Forest boundary near the Ruby Creek site, which is less than three miles north of existing public access in Robertson Draw. In contrast, general access to Gold Creek has been denied. The potential for improved access at either site is uncertain, however, since it would be necessary to obtain a legal right-of-way to provide for public use of route segments crossing private lands.

Cumulative Impacts

Recreation impacts associated with either alternative would be of limited magnitude. However, project impacts could combine with the impacts of potential future resource

exploration and development activities in surrounding areas to cause more substantially adverse impacts on recreation resources in the analysis area.

Specifically, recreationists have previously expressed concerns about the possible adverse effects of seismic petroleum exploration activities on wildlife resources and hunting opportunities in the Beartooth District (USDA-FS 1985). Also, the potential for other petroleum exploration and development activities, including possible future field development linked to this project, is a source of concern among recreation users. Any future seismic activities or other petroleum exploration and development that might occur simultaneously with and in the vicinity of this project could restrict the ability of recreationists to relocate and avoid exposure to project activities. Under such circumstances the proposed project could contribute to cumulative effects involving a deterioration of the recreation resource, although the incremental impacts of this one exploratory well would be small.

Mitigation Recommendations

Although the analysis has not identified major recreation impacts, the following mitigation procedures are suggested to reduce the magnitude of adverse effects on recreation in the project area. In addition, impact mitigation procedures specified for wildlife and visual resources would also help to reduce the magnitude of recreation impacts.

- Restrict construction and drilling activities during at least the first week of elk archery season and the first week of elk rifle season to reduce adverse impacts on hunting, if these activities continue into a second rifle season.

- Maintain existing regulations that prevent unauthorized public motorized travel on Forest lands in the analysis area, thereby minimizing the adverse effects of vehicle-related noise and dust on recreation.

Unavoidable Adverse Impacts

Even under full implementation of mitigation procedures, there would still be some significant unavoidable adverse impacts on recreation associated with either of the alternative locations for this exploratory drilling activity. These would include displacement of some hunters and a deterioration of the quality of recreation experiences available to those who continue to use the area. However, the number of individuals affected and the duration of such effects would be relatively small.

Comparative Analysis of Recreation Impacts

Recreation impacts associated with either of the drill site locations would be relatively minor. Changes in the recreation opportunity characteristics of both sites would be small. Short-term displacement of limited numbers of recreationists would occur, as would a deterioration of the recreation experiences available to others who would continue to use the surrounding areas. Although these impacts would involve relatively few people, the seasonal period designated for drilling activities would interfere with

big game hunting, which is the primary recreation use occurring in both locations. Beneficial consequences could result after project completion from improved public access to Forest lands providing opportunities for dispersed recreation.

Although the negative recreation impacts of either site would be minor except during the hunting season, the magnitude of negative effects would be smaller at the Gold Creek site. This is due to the slightly lower hunting activity reported for that location and the smaller number of acres that would require a revised ROS classification. Also, drilling at the Ruby Creek site would involve road development and project traffic that could interfere with recreational use of the seasonal residence located near the Forest boundary, while no residences are located near to the Gold Creek site.

In addition, the Gold Creek site may provide a slightly more favorable location for enhanced public access to the Forest if the FS were to secure the necessary rights-of-way following completion of project activities. Variation A1, Phillips' proposed access, would have the least impact on recreation. Variation A2 would have the greatest potential impact due to the greater length of public road used by recreationists. However, reconstruction and improvement of public roads along Variations A2 and A3 could improve recreationist travel conditions on these roads. Although there would be a reclassification of some areas from Semi-Primitive Motorized to Roaded Natural, this change would not be considered to be a violation of existing management direction.

Recreation Impacts of Field Development

The Draft EIS for this project contains a discussion which summarizes the type of field development activities that could occur if the exploratory drilling demonstrates sufficient oil and/or gas reserves to justify such efforts. A complete analysis of field development impacts would require substantially more information and analysis than has been developed for the current assessment effort. However, information currently available suggests that field development activities would have long-term and substantial adverse recreation impacts. The general features of the potential field development facilities on FS-administered land would be inconsistent with the current ROS designation of the affected area (SPM), requiring a redesignation of approximately 1,900 acres from SPM to RN. This would involve close to 40 percent of the SPM acreage in the analysis area and would therefore represent a notable impact on the recreation opportunity characteristics of the area.

Field development would also result in a substantial displacement of existing recreation uses in the affected area. Assuming that the several wells proposed for each drilling site would be developed sequentially, the duration of drilling activities could easily extend for a period of six to ten years or perhaps substantially longer, even if all three drill sites were developed simultaneously. During this period the quality of opportunities for hunting, hiking, and other dispersed recreation would deteriorate.

Noise and visual impacts generated by well field activities would extend over a much broader area than would occur with a single exploratory well. As a result, hikers and other dispersed recreationists would experience decreased satisfaction with the recreation qualities of the setting. Those recreation users who prioritize the isolation and solitude of undeveloped recreation settings would likely choose not to use the area.

Hunting would be negatively impacted by field development, due in part to adverse effects on the quality dimensions of the recreation setting. The scale of field development activities would impact a much larger contiguous area of the Line Creek Plateau face than would occur with a single well. Consequently, hunters would have difficulty redistributing themselves into adjoining areas. Moreover, any redistribution of hunting pressure into other available areas within the affected hunting unit would contribute to increased crowding and decreased hunter satisfaction.

In addition, the level of project-related road development and road use resulting from field development could affect hunting for pronghorn antelope, deer, and upland game on public and private lands east of the Forest boundary. Project traffic would also interfere with motorized recreation use of the Meeteetse Trail and other public roads in the area east of the Forest boundary.

These impacts would remain substantial throughout the entire drilling period, which as noted above would likely last for six to ten years or longer. Following completion of drilling, the impacts of a production well field would be somewhat lower. Nevertheless, there would still be long-term impacts on the recreation opportunity characteristics of the area as a result of enduring visual effects, noise, and other evidence of increased human activity.

The magnitude of these adverse effects could be reduced by implementing several mitigation procedures. One means of reducing impacts would involve relocation of the third well site from its proposed location near Robertson Draw to a point nearer to the Ruby Creek and Gold Creek drill sites. Ideally, this third well would be located at a point between the Ruby Creek and Gold Creek sites, thereby consolidating the area of greatest impact and increasing the potential for hunters and other recreation users to be redistributed into relatively unaffected surrounding areas.

In addition, the magnitude of impacts could be reduced by developing only one drilling site at a time, thereby minimizing the area of disruption during drilling activity, when adverse impacts tend to be most severe. Although this approach would extend the duration of drilling activity over a considerable time period, it would provide better opportunities for redistribution of recreation use into areas not immediately adjacent to the drilling location.

A third mitigation procedure that could reduce adverse impacts of field development on hunting would involve establishment of an earlier drilling termination date to reduce the degree to which drilling activities extend into the fall hunting season. Alternatively, the imposition of a moratorium on all project activities during at least the first week of both the elk archery and rifle seasons would reduce the degree of conflict between project activities and hunting recreation uses of the affected area.

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SOCIOECONOMICS

SOCIOECONOMICS TECHNICAL REPORT

Prepared For The

Ruby A Federal No. 1-9 Exploratory Oil/Gas Well Project

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May 12, 1989

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AFFECTED ENVIRONMENT

This technical report addresses the potential social and economic impacts of a proposed Phillips Petroleum exploratory oil/gas well in the Ruby Creek drainage of Carbon County, Montana. The report is intended to supplement material presented in the Draft Environmental Impact Assessment for the Ruby A Federal No. 1-9 Exploratory Oil/Gas Well, scheduled for release in May, 1989.

The proposed exploratory oil drilling activity would be located in southern Carbon County, Montana, approximately 2.8 miles north of the Wyoming border. The proposed and alternative well sites and access routes are in a rural area. There are no permanent structures in the immediate vicinity of either the proposed or alternative drill sites. There is a ranch house and out-buildings located at the end of Grove Creek Road, which could be used as an access route. There is also a seasonal cabin located about a mile east of the proposed drill site, near the Forest boundary.

The bulk of the social and economic effects of this proposed well would be diffused across the rural populations in Carbon County, Montana, and Park County, Wyoming. The population of Carbon County, Montana, was 8,173 in 1977 and is estimated to have grown to a current level of 8,461, or 0.4 percent annually. The communities nearest the drill site, Red Lodge, Bear Creek, and Belfry (see EIS, Exhibit G-1), had 1980 populations of 1,896, 62, and 227, respectively. Given the county's population growth rate, their estimated current populations are Red Lodge, 2087; Bear Creek, 68; and Belfry, 250 (Bureau of the Census, 1985). The population density of Carbon County is approximately 4.9 people per square mile, 9.4 percent below the state average of 5.41 people per square mile (see Table G-1).

Park County, Wyoming lies immediately south of the project area, and like Carbon County it is also predominantly rural. In this county the social and economic environment most likely to be affected by the proposal is Cody, which is the county seat and located 32 miles south-southeast of the proposed drill site (see EIS, Exhibit G-1). Cody has a current estimated population of 7,494 and is the retail and social center for the county. Park County is sparsely populated, with only 5.9 people per square mile. Even at this low population density, the county is 20 percent above the Wyoming average of 4.8 people per square mile. The estimated population of Park County is 23,882 and is projected to grow at approximately 1.09 percent annually through 1996 (Wyo. Div. Res. and Stat. 1986).

Both Carbon and Park counties have historically experienced energy extraction. The bulk of the energy extraction activity that has occurred in Carbon County is coal mining, which dates back to 1877 when diggings were begun near the present site of Red Lodge. The prominence of Red Lodge as a coal producer was enhanced in 1889 by the completion of the Rocky Fork and Cooke City branch of the Northern Pacific Railroad. The dominant twentieth century coal development in Carbon County was the mine at Bear Creek. This mine was destroyed by fire in the late 1940s, ending the major coal producing era in the county.

The history of energy development in Park County begins later than in Carbon County, and a higher level of activity continues today. The industry in Park County is based not on coal but on oil and gas. One of the oldest producing fields in the country, the

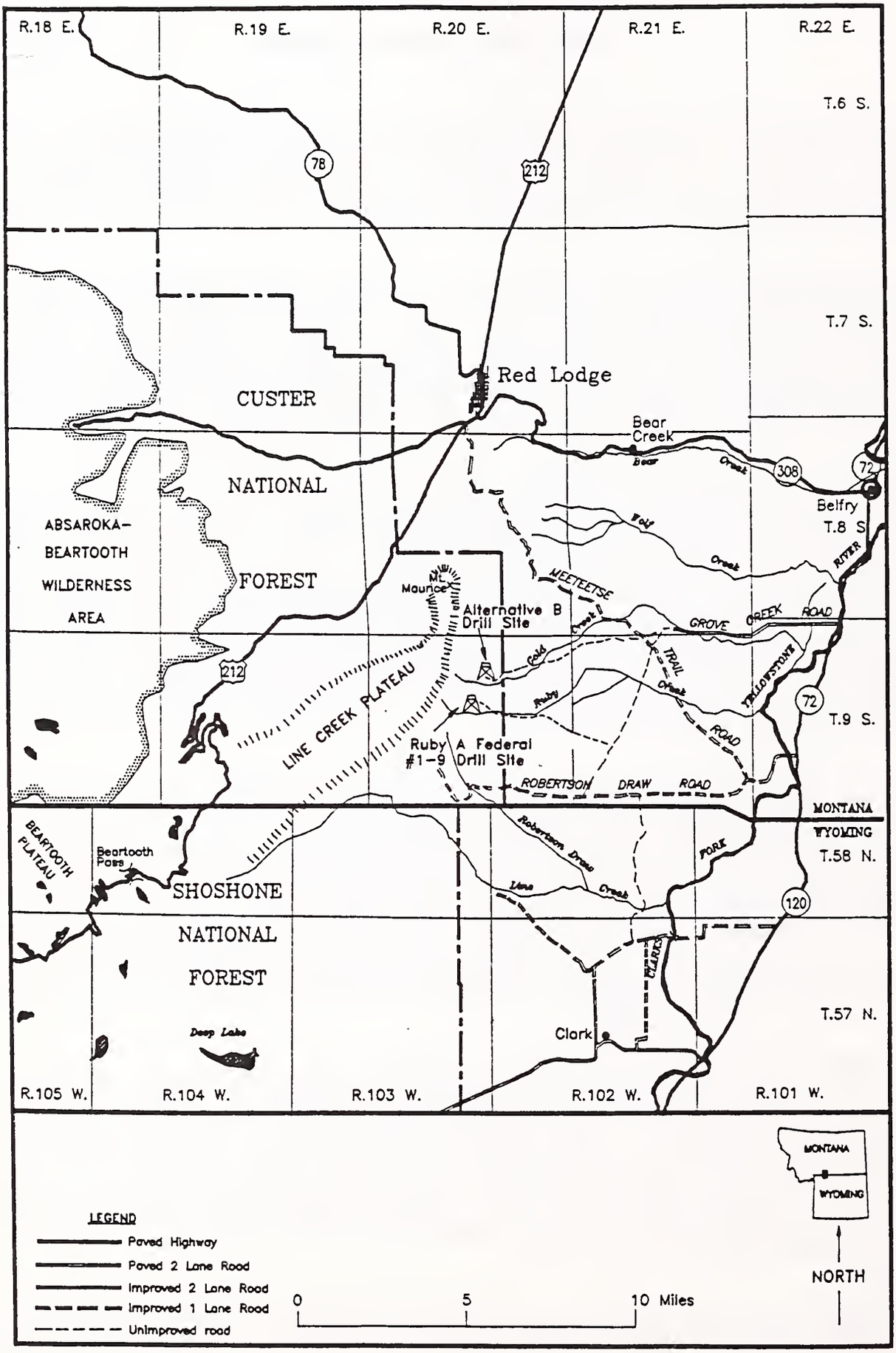

Exhibit G-1. Location of Phillips' Ruby A Federal No. 1-9 Exploratory Well Project in the Red Lodge, Montana Area.

Oregon Basin, is in the eastern part of the county. Much private and public land has been exposed to either oil and gas leasing, exploration, or production. Consequently, the additional exploration that is currently proposed by Phillips is consistent with existing trends in Park County, and will not require the population of Cody or surrounding areas to alter the way it interacts with or perceives the natural environment.

Carbon and Park counties have relatively underdeveloped economies, with Carbon County the less well-off of the two. Carbon County has a much lower total personal income than does Park County: the former was only 27.4 percent of the latter in 1986 (Tables G-2 and G-3). The smaller population in Carbon County does not account for all of this difference because the per capita income is 21 percent higher in Park County. The difference is even more obvious if transfer payments, dividends, interest, and rents are removed from total personal income. In this case, Park County's 1986 per capita income is 54.6 percent larger than in Carbon County. Carbon County gets 22 percent of its total personal income from transfer payments (Social Security, federal pensions, etc.) while the state averages for Montana and Wyoming are 18 percent and 13 percent, respectively. The higher level of transfer payments to Carbon County residents may be due to a larger number of retirees, particularly elderly widows from the Bear Creek mine disaster.

Both Carbon and Park Counties draw substantial economic strength from mining (mainly oil and gas) and services (mainly tourism). In Carbon County, mining represents 10.4 percent of the non-farm private earnings for 1986, while services provide 30.7 percent. Mining represents 21.5 percent of the 1986 non-farm earnings in Park County, while services are 23.0 percent.

The level of earnings that these counties receive from mining has varied considerably in recent years, as Table G-4 shows. The long-term earnings trend is downward for Carbon County (losing 35 percent nominally between 1980 and 1986) and upward in Park County (gaining 21 percent nominally over the same period). Both counties show substantial nominal increases in their earnings from services between 1980 and 1986: Carbon County was up 141 percent and Park County was up 98 percent.

The 1980 to 1986 increase in earnings from services can reasonably be attributed to long-term growth in the tourist industry. Tourism in Park County in the summer of 1987 was 7.2 percent above the comparable period in 1986 (Morey 1987), but probably declined substantially in 1988 because of the severe fire season in Yellowstone National Park. The residential populations in the counties grew slowly over the 1980-86 period--Carbon County up 0.4 percent per year and Park County up 2.6 percent per year--implying that the local need for services did not grow rapidly enough to account for the growth in service-related earnings. Moreover, these counties' shares of total earnings from services are higher than average for non-metropolitan regions of their states. These relationships support the conclusion that the bulk of the growth in services in these counties is attributable to tourism/recreation, since neither population changes or statewide economic changes can account for it.

The relationship between the mining and tourism industries is an important and delicate one for these counties. Some area residents recognize their historical dependence on oil, gas, or coal, and view continued minerals development as an important source of economic stability. However, other residents see their future

Table G-1. Populations of Montana and Wyoming, Non-Metro Montana and Wyoming, Carbon County, and Park County from 1977 to 1986.

Area	Year							
	1977	1980	1981	1982	1983	1984	1985	1986
Montana	771,342	788,282	795,756	805,040	815,801	823,473	825,453	818,928
Non-metro Montana	581,397	599,953	605,088	611,305	617,438	622,938	644,806	619,367
Carbon Co.	8,173	8,076	8,174	8,315	8,529	8,665	8,580	8,461
Wyoming	411,521	474,552	493,864	510,435	516,418	512,879	509,707	507,355
Non-metro Wyoming	350,001	402,092	347,870	361,846	366,223	364,794	363,87	5361,204
Park Co.	19,610	21,752	22,478	23,473	24,003	24,645	24,564	24,869

Sources: USDC 1984; USDC 1988

Table G-2. Per Capita Personal Income for Montana and Wyoming, Non-Metro Montana and Wyoming, Carbon County, and Park County.

Area	Year							
	1977	1980	1981	1982	1983	1984	1985	1986
Montana	6,161	8,361	9,875	10,084	10,424	10,835	11,041	11,821
Non-metro Montana	5,895	8,044	9,571	9,664	9,980	10,333	10,541	11,435
Carbon Co.	5,524	7,637	9,119	9,253	9,109	9,289	9,857	10,691
Wyoming	7,535	11,040	12,332	12,236	11,836	12,244	12,914	12,774
Non-metro Wyoming	7,121	10,470	11,804	11,647	11,349	11,711	12,460	12,436
Park Co.	7,832	10,784	12,600	12,497	12,585	12,822	13,203	13,002

Sources: USDC 1984; USDC 1988

Table G-3. Total Personal Income for Montana and Wyoming, Non-Metro Montana and Wyoming, Carbon County, and Park County (in $1000's).

Area	Year							
	1977	1980	1981	1982	1983	1984	1985	1986
Montana	4,752,237	6,590,829	7,858,105	8,118,020	8,503,906	8,922,334	9,113,826	9,680,542
Non-metro Montana	3,427,338	4,826,018	5,791,297	5,729,494	6,162,028	6,436,817	6,579,601	7,082,456
Carbon Co.	45,145	61,676	75,189	76,941	77,687	80,486	84,572	90,459
Wyoming	3,100,814	5,239,054	6,090,325	6,245,682	6,112,322	6,279,690	6,582,351	6,480,953
Non-metro Wyoming	2,492,359	4,209,906	4,106,262	4,206,717	4,156,268	4,272,097	4,533,887	4,491,934
Park Co.	153,584	234,572	283,225	293,342	302,080	315,993	324,316	323,347

Sources: USDC 1984; USDC 1988

Table G-4. Earnings by Selected Industry for Montana and Wyoming, Non-Metro Montana and Wyoming, Carbon County, and Park County (in $1000's).

Area	Year							
	1977	1980	1981	1982	1983	1984	1985	1986
Montana								
Mining	129,611	234,312	326,826	289,520	242,132	246,940	234,538	210,012
Services	546,248	750,329	968,020	1,026,324	1,107,372	1,210,939	1,297,307	1,359,837
Civilian govt.	679,890	878,846	959,724	1,032,058	1,107,729	1,166,617	1,229,707	1,240,163
Non-metro Montana								
Mining	121,007	202,537	275,105	256,929	210.190	208,566	200,309	181,509
Services	369,458	504,218	621,870	656,877	707,974	769,230	829,870	NA
Civilian govt.	528,311	694,890	761,619	820,292	880,229	926,938	982,702	982,604
Carbon Co.								
Mining	NA	2,700	3,721	1,625	1,372	1,480	2,839	1,758
Services	NA	2,815	4,530	4,811	5,320	5,777	6,380	6,779
Civilian govt.	4,309	5,364	5,821	6,400	6,871	7,078	7,403	7,851
Wyoming								
Mining	523,615	1,021,545	1,226,809	1,188,455	1,039,526	1,032,187	1,002,734	826,182
Services	271,211	479,870	603,505	628,600	609,324	655,757	693,294	713,809
Civilian govt.	428,779	633,740	736,485	843,970	918,848	974,736	1,027,545	1,049,822
Non-metro Wyoming								
Mining	406,657	804,121	947,910	928,426	840,022	833,164	822,388	710,561
Services	204,498	324,289	385,309	385,298	378,616	409,212	436,463	449,663
Civilian govt.	372,146	548,972	479,327	541,200	609,589	649,908	687,966	711,394
Park Co.								
Mining	14,450	28,048	40,230	39,057	37,315	37,114	39,725	34,067
Services	15,032	18,091	32,719	34,219	32,967	36,565	35,848	35,867
Civilian govt.	21,981	28,873	32,075	34,844	38,922	45,386	49,152	51,060

Sources: USDC 1984; USDC 1988

economic growth as being tied increasingly to recreation/tourism. This transitional economic status means that additional hydrocarbon proposals are viewed as attractive and likely to receive public support only if the unique physical environment can be preserved. This contrast between development and natural beauty is represented in the attitudes of the local population. Two opposing themes seem to characterize locals' attitudes about oil and gas or other resource developments. One group supports relatively unconstrained development and is willing to accept alteration of the physical environment. Another group advocates maximum preservation of the existing environment and an implicit willingness to forego the economic opportunities associated with various resource developments, such as the proposed Ruby Creek project. Examples of both attitudes are represented in the comments received during the scoping process for this project and for previous oil well proposals on adjacent forests.

Associated with the low-development desires of part of the local population is a preference for continued growth in the local tourist/recreation industry. The assumptions behind this attitude are that tourists coming to the region are attracted by the natural environment and that a growing tourist industry will therefore make future economic expansion less likely to require extensive environmental modifications or major alterations of the small-town and rural lifestyles valued by many area residents.

There are some substantial qualitative differences in the tourism industries in Carbon and Park Counties. Both counties benefit greatly from their proximity to Yellowstone National Park, but Carbon County serves a regional clientele while Park County serves a more national one. US Highway 212 through Carbon County is a less heavily used travel route into the park compared to the east entrance that is accessed through Park County, Wyoming. The US Highway 212 access has recently been designated as an official scenic byway. Carbon County most importantly provides access to the Beartooth Plateau and the Absaroka-Beartooth Wilderness Area, which are used heavily by Montana residents, particularly from the Billings/Yellowstone County metropolitan area. As such, changes in Carbon County's ability to accommodate tourists would be felt primarily at a regional level.

ENVIRONMENTAL CONSEQUENCES

Introduction

Nearly all of the socioeconomic impacts of the proposed exploratory well are expected to be indirect and diffused throughout the local populations. There would be few direct socioeconomic impacts because there are few permanent dwellings in the proximity of the proposed drill site. There is a seasonal residence approximately one mile east of the proposed drill site, but the nearest permanent housing is at a ranch approximately six miles northeast of the site.

Impact Significance Criteria

Social impacts were evaluated on the basis of the following criteria:

- Demographic impacts involving a greater than ten percent increase on a local population, based on the assumption that such growth could strain the capacity of infrastructure in area communities.

- Any permanent displacement of residents or users of the affected area, identifiable changes in or conflicts with existing ways of life or levels of dissatisfaction likely to generate organizational response and conflict.

The aggregate economic impacts for the proposed development can be disaggregated into separate impacts associated with individual resources. Resources that may involve significant economic impacts are big-game hunting (both guided and non-guided), dispersed summer recreation, timber, and the aggregate local economy. Impacts were defined as significant if they had the following effects:

- An aggregate change in revenue flows likely to produce significant social impact within area communities.

- An aggregate change in non-market values likely to produce significant recreational or social impacts within area communities.

The socioeconomic impacts of the proposed project activities would be distributed across Carbon County, Montana, and Park County, Wyoming. All impacts are likely to be more pronounced in Carbon County than in Park County. Several factors support this conclusion:

1. The larger population in Park County could more easily assimilate any population changes associated with the proposal.

2. A larger proportion of Park County's economy is based on energy exploration and production, which tends to make the population more comfortable with energy developments than it otherwise would be.

3. A substantial proportion of oil rig and other workers would come from Cody, but since the Cody area labor force already contains substantial numbers of oil and gas industry workers, there would be little likelihood of significant in-migration of new residents.

4. There is little recreation use in the analysis area by Park County residents because there are comparable recreational opportunities in Wyoming and because Wyoming residents using the area for hunting would have to pay the higher Montana non-resident hunting fees.

The remainder of this discussion will therefore concentrate on social and economic impacts likely to arise in Carbon County, since this county would be more sensitive to decisions made on this proposal than would be the case in Park County. Thus, if an alternative has no significant impact on Carbon County, presumably the impact on

Park County would also be insignificant. In addition, if a remedial measure could mitigate the significance of an impact in Carbon County, it would probably have equal success in Park County.

Direct and Indirect Impacts -- Alternative A (Ruby Creek)

Drilling and construction activities associated with this alternative would have modest and generally insignificant impacts on the socioeconomic environment in Carbon County. Social impacts could arise in part as a result of population increases caused by in-migration and disruption of existing lifestyles. However, the number of people working on the project at any one time would be less than twenty. Some of the people who would work on construction of the road and pad, or on the drilling itself, may already live in the area. The additional workers would probably relocate temporarily, and would often not bring their families. Even if there was more permanent in-migration caused by the project, the housing supply, schools, and other portions of the public infrastructure in Carbon and Park counties could accommodate the additional demand likely to result from the exploratory drilling proposal.

Some local residents who oppose petroleum exploration and development in this area could experience increased dissatisfaction with environmental conditions and with decision makers responsible for public land management. In addition, the lifestyles of some residents living near to access route corridors could be altered, due to the introduction of increased road use and activity in an area currently characterized by relative isolation and a secluded rural lifestyle. For example, residents of the Anderson ranch near the beginning point of access Variations A1 and A2 would experience increased noise, dust and traffic levels that could force some shifts in established behavior patterns. Similar effects could be experienced by a somewhat larger number of residents living near to the A4 road corridor.

For this project area the economic impact can be divided into three categories: tax revenues, community revenues, and non-market benefits. The tax revenues come from the property tax levied against the taxable value of the drill rig and the associated equipment when the equipment is in Carbon County. The community revenues are estimates of the monetary inflows that would result from the proposed action. No multipliers are used in calculating community revenues because the objective is to show financial impacts to, rather than movements through, the area. The non-market values included in the analysis are hunting/fishing and all other recreation. Other non-market outputs potentially available from the area include forage and water. The range potential on FS lands is currently not captured because no grazing is permitted on FS lands in the project area. Similarly, as indicated in the Vegetation Section of the Draft EIS, the forage loss due to road improvement on BLM lands would be negligible. There is no data on the use or value of water coming from Ruby Creek. This incomplete data makes a definitive estimation of present net value or benefit-cost ratios impossible. As such, neither have been provided.

Table G-5 summarizes the economic impact resulting from the proposal. The No Action Alternative produces no tax or community revenues but provides the highest level of non-priced benefits. Both the proposed drill site (Ruby Creek) and the alternative site (Gold Creek) result in reduced non-priced values because the level of recreation,

Table G-5. Economic Impacts Due to the Proposed Action (Ruby Creek), Alternative Action (Gold Creek), and No Action Alternative.

	No Action	Ruby Creek	Gold Creek
	$1000	$1000	$1000
Property Tax Revenues	0	141	141
Revenues to Community			
Drilling Crew Wages	0	96-119	102-128
Site/Road Construction and Reclamation	0	200-250	200-250
Mobilization	0	15-20	15-20
Other	0	50-116	51-119
Non-priced Values			
Hunting	66.4	64.8	64.8
Other Recreation	52.5	51.1	51.1

Assumptions: Ten year analysis period; Four percent discount rate; All recreation down 30% the first and second years; All recreation down 10% the third year, follows Custer Forest Plan in subsequent years.

Source: Summary of Tables 4-5 through 4-7

Table G-6. Estimated Community Revenue Impacts by Alternative.

Community Revenue	Ruby Creek (cost $)	Economic Impact Ruby Creek ($)	Gold Creek (cost $)	Economic Impact Gold Creek ($)	Percent of Revenues Remaining in Community
Rig Costs					
Rig Hardware	$ 953,175	0	$ 952,650	0	0
Crew Wages	477,400	95,480-119,350	511,500	102,300-127,875	20-25
Construction and Reclamation of Site and Road	1,000,000	200,000-250,000	1,000,000	200,000-250,000	20-25
Mobilization	100,000	15,000- 20,000	100,000	15,000- 20,000	15-20
Drilling Tangibles[1]	538,000	0	551,000	0	0
Directional Drilling	600,000	0	630,000	0	0
Other Unspecified Intangibles	1,653,000	49,590-115,710	1,701,000	51,030-119,070	3-7

1 - Casings, tubings, etc.

Source: Phillips Petroleum 1988

attractiveness, and use of the project area would diminish during the proposed project. The action alternatives produce tax and community revenues that the No-Action Alternative does not.

Tables G-6 through G-7 show the details of the economic impact calculations that are summarized in Table G-5. Table G-6 shows the detailed costs of the project by category and estimates the level of resulting community resources. Table G-7 shows the costs of the different Alternative A roading variations and of Alternative B. The Alternative A costs are sufficiently similar that the road chosen will not significantly affect the economic impact of the proposal. Both Tables G-5 and G-6 are based on the road costs for Phillips' proposed access route (Variation A1).

Monetary impact calculations are based on non-market value or recreation value changes resulting from the proposed project. These changes would result from either lost recreational use or diminished quality of remaining recreational activities in the project area. Table G-8 shows the derivation of the recreation values and assumes that the recreation use drops by 30 percent the first two years and by ten percent in the third year. The sources of recreation value changes or losses include 1) reduced recreation use in the immediate project area; 2) reduced willingness-to-pay for the remaining use in the project area; and 3) reduced willingness-to-pay for recreation at other sites that experience higher use levels because of recreationists displaced from the project area. This approach is based on the hypothesis that even though the use may be eliminated from the immediate area during project implementation, most of the use would be displaced rather than eliminated entirely.

Table G-5 shows that despite the loss in non-priced benefits, both of the action alternatives produce substantial tax and community revenues. The tax revenues alone are estimated to be over 25 times larger than the value of the recreation losses for either action alternative. From a strictly financial perspective, the proposed action would likely have a substantial net positive impact. This conclusion ignores distributional issues that may arise because some individuals may be negatively impacted but do not share in the economic benefits. This conclusion also ignores the non-pecuniary aspects of the social environment.

Direct and Indirect Impacts -- Alternative B (Gold Creek)

The social and economic impacts of the Gold Creek drill site and access road would be virtually indistinguishable from those arising from the proposed alternative. Substantial positive net economic benefit would result, regardless of the eventual productivity of the well. Losses to non-market values would be minimal and temporary. In-migration would be slight, and no meaningful decrease in the overall satisfaction levels of local populations is expected.

Impacts Summary

Every indication is that any negative socioeconomic impacts resulting from either the proposed or alternative actions would be minimal. Some individuals, such as hunters, hunting outfitters, and the few residents living adjacent to the various alternative access routes may be adversely affected. Additional people may feel that the economic future of the area lies not in extractive industries but in recreation/tourism.

Table G-7. Cost of Roading Alternatives and Variations.

Road Variation	Miles of Road	Estimated Costs ($)
Alternative A		
A1	14.1	30,900
A2	22.9	46,500
A3*	13.2	199,100
A4	18.0	39,000
Alternative B	11.2	27,600

* - includes the cost of bridge reconstruction

Source: Table 4-1

Table G-8. Recreation Value Calculations.

Recreation Use Rates for Line Creek Analysis Area (RVD/acre)

	Hunting and Fishing	Other Recreation
First 5-year period	0.24	0.25
Second 5-year period	0.27	0.29
Third 5-year period	0.29	0.33
Fourth 5-year period	0.32	0.38
Fifth 5-year period	0.35	0.42

Values per RVD (1978 dollars):

Hunting and Fishing	$2.75/RVD
Other Recreation	$3.66/RVD

Recreation Value[1] by Alternative

Year	No Action	Ruby Creek	Gold Creek
1	$3396:4331	$2377:3054	$2377:3054
2	3396:4331	2377:3054	2377:3054
3	3396:4331	3056:3926	3056:3926
4	3396:3441	3396:3441	3396:4331
5	3396:3441	3396:3441	3396:3441
6	3911:4908	3911:4908	3911:4908
7	3911:4908	3911:4908	3911:4907
8	3911:4908	3911:4908	3911:4908
9	3911:4908	3911:4908	3911:4908
10	3911:4908	3911:4908	3911:4908
Discounted @4% and inflated using the CPI	52456:66386	50172:63578	50178:63578

1 - Values are presented as ratios; Hunting and Fishing : Other Recreation.

Source: Logan 1988

Nevertheless, the negative social effects would be minimal. The negative economic impacts are a minimal loss of recreation benefits, and these are offset in the aggregate by property taxes and a substantial increase in community revenue flows.

Cumulative Impacts

The proposed exploratory oil well project would not meaningfully add to negative cumulative impacts in the region, even if other unanticipated resource development activities were to occur during the same time frame. This conclusion is based on the absence of significant adverse socioeconomic impacts from this one small project.

Impact Mitigation Recommendations

Since no significant impacts are expected, no mitigation would be required for the proposed exploratory drilling activities.

Unavoidable Adverse Impacts

No significant unavoidable adverse impacts would occur to socioeconomics due to implementation of either alternative.

Comparative Analysis of Socioeconomic Impacts

As discussed above, minimal negative socioeconomic impacts would result from project implementation at either location. Some individuals, such as a few hunting outfitters or the owners of the seasonal residence adjacent to the Forest boundary, may be adversely affected. Additional people may feel that the economic future of the area lies not in extractive industries but in recreation/tourism. The negative economic impacts include a minimal loss of recreation benefits. These impacts are offset by property taxes and a substantial increase in community revenue flows.

There would be no difference in the type and magnitude of impact between Alternative A and Alternative B. Alternative A access route Variation A3 would impact local residents the least since none occur along this route. Variation A1, Phillips' proposed access, however, would have less impact on recreationists using the Meeteetse Trail or Robertson Draw road. The proposed project would not violate existing management direction in regard to socioeconomics.

Socioeconomic Impacts of Field Development

Social

Field development activities could give rise to more substantial social impacts than would result from a single exploratory well. Although the level of public controversy generated by proposals for smaller-scale petroleum projects in the Red Lodge area is moderate, consideration of field development activities would be likely to act as a

catalyst for increased dissatisfaction among wildlife interest groups and various other environmental preservation interests. Concern and opposition among area residents who prioritize tourism and recreation as the focus of economic development opportunities could also be anticipated. One result would be an increased potential for local community conflict between those who prioritize the economic benefits and opportunities that could result from petroleum development and those who advocate the maintenance and preservation of natural environmental conditions or who prioritize economic growth based on recreation and tourism (see Greider and Little 1988). In addition, those who oppose expanded petroleum development could be expected to express increased dissatisfaction with federal land management decisions, perhaps exacerbating the level of tension between some public interest groups and the Forest Service.

In addition, the rural lifestyles currently experienced by some residents of ranches and small communities located near to the well field location could be significantly altered. The levels of traffic, road upgrading, and other project activities associated with well field development would remain high throughout the period of drill site development and drilling activity. These activities could alter the solitude and isolation experienced by individuals living at the handful of ranchers and homes dispersed in proximity to the various access routes.

Also, a field development level of project activity could result in levels of in-migration by project personnel that would strain the ability of local communities to absorb increased demands for housing, public services, and other infrastructure. Such population growth could also disrupt the operation of established social structures that provide informal mechanisms of social support, social control, and social integration in rural communities (see Freudenburg 1986). Such impacts would be of limited magnitude due to the limited extent and scale of the field development activities presently under consideration.

If the drilling and development activities were spread over a relatively long time period, the size of the project workforce and the degree of in-migration occurring during any single time period would be reduced. In contrast, rapid development of field facilities would likely require a larger workforce and could generate in-migration sufficient to trigger relatively short-term but significant impacts on lifestyles, social relations, and community infrastructure. Such impacts would be particularly problematic if project workers were to locate in smaller communities, such as Bear Creek and Belfry, that are located nearest to the project area.

Economics

The economic impacts of field development would generally involve net positive effects on revenue flows in the affected counties and communities. Negative economic impacts could include some loss of recreation-related employment and revenues and increased costs for public service provision. However, these would be substantially offset in the aggregate by increased property taxes, revenues generated by the state severance tax and the county net proceeds tax, and increased employment and wages generated by the project.

The economics of the proposed Ruby A Federal Prospect change substantially if the well indicates commercially feasible quantities of oil. The following discussion extends the

preceding analysis of socioeconomic effects of an exploratory drilling project to include the economic ramifications of oil production from the Ruby Creek area.

Phillips indicates that the preferred oil extraction strategy would involve three sites, each containing six wells. The wells would be drilled simultaneously. The limited period each year in which drilling could occur implies that drilling and completing each well would take, on the average, one season. The effective project life is therefore about 20 years: 6 to 10 years for drilling and 10 to 14 years of production after the final well is drilled. Production is estimated at 350 barrels of oil per day for the life of the field.

Table G-9 summarizes the economic impacts of oil production from this size facility. Production would generate substantial federal royalties, but those are not applicable to this locally-defined analysis area and are therefore not included in the figures reported in Table G-9. Additional economic impacts could occur beyond the project area and include state and federal revenues. However, the analysis does not directly consider these additional revenues since they would occur outside of the area of immediate interest. In 1988 the federal oil and gas estate in Carbon County returned $737,360 to the state and an equal amount to the federal government. The state redistributes some of these funds under an equalization formula for public education (Jaquith, 1989). Thus, Carbon County would receive a portion of the state revenues derived from development of this oil/gas field.

As with the exploratory well, the economic impacts come from tax revenues, community revenue flows, and changes in non-market values. In each of these three areas, however, the size of the impacts changes substantially when considering the effects of field development rather than an exploratory well.

The addition of oil production means that two new taxes would be levied against the development project: the Montana oil and gas severance tax and the county net proceeds tax. The details of calculating these taxes, as well as the property tax, are shown in Table G-10. Table G-9 shows that the present net value of these taxes is likely to be substantial at the anticipated production levels.

The community revenue flows are the inflows of money into the local economies that is attributable to the development proposal, given a production scenario. The categories of expenditures that are expected to be partially captured by local businesses or workers are drilling and maintenance crew wages, pipelines, site and road construction and reclamation, and drilling intangibles. No multipliers are used to estimate community revenue flows because the objective is to measure inputs to, rather than movements through, the local economies. One direct local impact that may occur is a change in property values to the private lands adjoining the FS boundary near Ruby Creek (particularly the currently undeveloped Towe subdivision). There are no data available with which to predict any property value changes attributable to the proposal.

The non-market value changes (i.e., non-priced values) would result from either lost recreation or diminished quality of remaining recreational activities in the project area. This measure of recreational value represents not merely recreation expenditures or license fees, but is based on the more comprehensive concept of willingness-to-pay. The sources of recreation value changes or losses include 1) reduced recreation use in the immediate project area; 2) reduced willingness-to-pay for the remaining use in the project area; and 3) reduced willingness-to-pay for recreation at other sites that experience higher use levels because of recreationists displaced from the project area. Table G-9 assumes that 80 percent of the recreation value is lost in the recreation

Table G-9. Economic Impacts of Production.

	No Action	Proposal
Property Taxes		
Drilling Equipment	0	2,104,818
Pipeline	0	862,077
Tanks	0	50,752
County Net Proceeds Tax	0	4,352,451
State Severance Tax	0	17,409,895
		24,779,993
Revenues to Community		
Crew Wages		
Drilling	0	1,251,877-1,564,848
Maintenance	0	402,995-503,744
Construction and Reclamation		
Drill sites and roads	0	414,425-518,031
Pipeline	0	133,056-310,464
Drilling intangibles	0	698,109-1,628,920
		2,900,462-4,226,007
Non-priced Values (RVDs)		
Hunting and Fishing	82,263	36,821
All Other Recreation	112,082	38,694
	194,345	75,515

Assumptions: 3 sites, 6 wells per site; 1 well per site every 2 years; wells produce 350 barrels/day for 10 years; 4 percent discount rate; tax codes remain constant; recreation by 80 percent for the 12 year construction and drilling period, and by 20 percent for the following 10 year production period.

analysis area during the 12 year construction and drilling period, and that 20 percent of recreation value is lost during the 10 year production period. The area affected is described in Recreation sections of Chapter 3 of the EIS and in the Recreation technical report, and includes about 4,920 acres. There are additional non-market values that might be affected (water and forage for example) but there is inadequate data to estimate the effects on those resources.

Table G-9 shows that there would be substantial net local economic benefits if the Ruby Creek drilling proposal resulted in oil production. The tax revenues to state and county governments are two orders of magnitude larger than the lost non-market values, and the community revenue inflows are one order of magnitude larger. This

result merely reinforces the obvious conclusion that oil wells can be lucrative and does nothing to address the distributional issues. These latter issues are important because the proposal would most likely negatively impact some people while disproportionately benefiting others. The net aggregate fiscal effects would nevertheless be positive. Moreover, the tax and community revenues are so much larger than the non-market losses that even if there is uncertainty about the size of any single value, it should not produce uncertainty about the aggregate result.

Table G-10. Tax Revenue Calculations.

State Severance Tax

For wells with production less than 10 barrels per day:
1-5 barrels per day exempt from tax
Additional production taxed at 0.03 of gross value

For wells with production greater than 10 barrels per day:
All production taxed at 0.05 of gross value

All wells exempt from this tax for the first 24 months of operation.

County Net Proceeds Tax

Net proceeds are gross proceeds minus qualified expenses.

Tax is net proceeds multiplied by appropriate mill levy.

All wells exempt from this tax for the first 12 months.

Property Tax (on drilling equipment)

Rig value multiplied by taxable value percentage (11% for all drill rigs).

Taxable value multiplied by appropriate mill levy.

Prorated by proportion of year in state.

Source: Chenoweth 1988, Steinmaisal 1988

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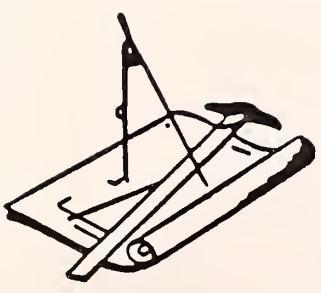
ENGINEERING

BRIDGE RECONNAISSANCE REPORT

SOUTH ACCESS ROUTE

EXPLORATORY WELL
RUBY FEDERAL A19

14 DECEMBER 1988



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BRIDGE RECONNAISSANCE REPORT

SOUTH ACCESS ROUTE

EXPLORATORY WELL
RUBY FEDERAL A1-9

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I INTRODUCTION

It is proposed that an exploratory well be constructed in the NW¼NW¼ of Section 15, Township 9 South, Range 20 East of the Montana Meridian, Carbon County, Montana. The site is approximately 3 miles North of the Wyoming/Montana State line in the Custer National Forest. Two access routes to the site are possible. Both routes extend Westerly from Montana Highway 397. And, both access routes utilize existing gravel roads that cross private lands, Bureau of Land Management lands and National Forest Service lands. Both the North and South routes must be improved for use as a well site access. The improvements may include grading, shaping and gravel surfacing, widening in some areas and installing storm drainage piping for conveyance of surface water. Only the Southern route requires crossing the Clarks Fork of the Yellowstone River.

The Southern route crosses the Interstate Irrigation Ditch and the Wills Irrigation Ditch. The Wills Ditch is crossed by a concrete box culvert. The Interstate Ditch is crossed by a modified railroad car. Improvements to the Interstate Ditch crossing will be required.

PURPOSE

The purpose of this reconnaissance report is to present a cursory evaluation of the adequacy of an existing bridge over the Clarks Fork of The Yellowstone River for the Southern access route.

OBJECTIVES

The objectives of this report are to identify ahead of preliminary and final design and ultimately construction, the cost effectiveness, the constructability, and the environmental compatibility of providing improvements to the Southern access route river crossing. The improvements to be identified herein are limited to the river crossing. Specifically, the objectives of this reconnaissance report are as follows:

- Identify the condition of the existing structure
- Establish criteria for a crossing

- Identify improvements to and costs of utilizing the existing structure
- Identify alternatives to the existing structure with cost estimates
- Provide recommendations for improvements to cross the Clarks Fork of the Yellowstone River

FINDINGS AND CONCLUSIONS

The following are the findings and conclusions of this reconnaissance report that led to the recommendation:

- The existing steel truss bridge is generally, in good condition
- The existing bridge will not carry anticipated loads without modifications
- The existing bridge is rated at 8 tons maximum
- The existing bridge is 16 feet wide (single lane) and spans 200 feet
- A detailed analysis of the existing bridge was not performed
- Normal highway load limits are 18,000 pound axle and 80,000 pound gross weights
- For this report, oversized load limits of 20,000 pound axle and 100,000 pound gross weights were used
- A river ford and a temporary pontoon type bridge were rejected as viable alternatives
- Constructing a new bridge is a viable alternative
- The estimated project costs of a new bridge are $470,000
- A new bridge would be two lane with a sidewalk that spans 200 feet and is 30 feet wide
- Temporarily modifying the existing bridge is a viable alternative
- Modifying the existing bridge would cost approximately $166,000
- Construction time of modifying the existing bridge is the shortest
- The environmental effects of the existing bridge modifications would have the least impact

RECOMMENDATION SUMMARY

If the Southern access route to the well site is selected, the existing bridge modifications alternative is recommended. The costs are estimated to be the least, environmental effects are the least and construction time is the least.

II EXISTING CROSSING

The existing crossing is a through truss steel bridge crossing the Clarks Fork of the Yellowstone River. It is approximately 1,000 feet West of Montana Highway 397 beyond the Wills Irrigation Ditch. And, it is in the NW¼NW¼ of Section 29, Township 9 South, Range 22 East of the Montana Meridian, Carbon County Montana. It is assumed that the bridge is part of an unmarked county road that intersects with Montana Highway 397 2.2 miles North of the Wyoming State Line.

The bridge is supported at each end by concrete abutments and spans 200 feet. The concrete contains some cracks but, appeared to be in good condition. No spalling was observed.

Due to the age of the bridge, it is assumed that A-7 steel was used. The bridge is made of 10 panels, each pin connected, 20 feet in length. Nine I-beams 15"X5½", 16 feet long serve as cross members at the bottom of each panel. The cross members support eight longitudinal I-beams 10"X4½" that support asphalt over wood plank bridge decking. The wood planks are 2"X6" rough lumber turned on end and placed accross the longitudinal I-beams (16 feet±)

The main overhead frame members are a box beam made of two 10"X23/4" channels with a riveted steel plate on top and latice steel on the bottom. Maximum overhead clearance between the deck and sway bracing is 14 feet 9 inches.

For the limited scope of this report, detailed design drawings and calculations of the bridge were not obtained or generated. A load limit sign placed in front of the bridge states 8 tons maximum. Based on our observations, we believe the maximum load limit is conservative and, is the result of the wooden deck.

III CROSSING ALTERNATIVES

LOAD CRITERIA

Normal highway load permits are issued for maximum 18,000 pound axle loads and 80,000 pound gross weight. Oversized load permits are also issued. It may be more economical to transport certain equipment and materials that would exceed normal permit load limits.

For the purposes of this report, we have selected 100,000 pounds gross weight on two pairs of duel axles and one single axle. Maximum axle loading selected for analysis is 20,000 pounds.

ALTERNATIVES ANALYSIS

Several alternatives for crossing the Clarks Fork of the Yellowstone River were considered.. The alternatives included modifying the existing steel truss bridge, removing the existing bridge and constructing a new bridge, constructing a temporary river ford, and placing a temporary pontoon type bridge.

River Ford

A temporary river ford was rejected as a viable alternative for two main reasons. The obvious reason is the large quantity of flow in the river during low runoff periods. The second, and perhaps less obvious reason, is the environmental damage that may be caused by a river ford.

Pontoon Type Bridge

A temporary pontoon bridge crossing was also rejected as an alternative for analysis. Constructability, cost and environmental damage were the main reasons. Although flow in the river is large, it is believed that a pontoon bridge would bear on the river bottom for much of its span. The costs of purchasing, installing and removing a pontoon bridge would be better applied to another alternative. And, the impact to the environment for 6 months may be significant.

Truss Bridge Modifications

Although the specific capabilities of the existing bridge are unknown, it is possible to temporarily modify it to carry anticipated loads. The modifications would include placing two steel girders, on independent concrete foundations, under the existing cross members, replacing the wood and asphalt decking with adequate steel grate decking, and miscellaneous truss restoration.

The required steel girders would be approximately W36X300 (wide flange) 200 feet long. The 36 inch depth of the girders could interfer with the high water or flood elevation of the river and could act as a dam during periods of high water. Therefore, this alternative is considered to be temporary and, the girders would be removed.

Constructability

Constructability of this alternative is practical and would not interfer with the flow in the river or significantly impact the environment. Independent concrete foundations would be placed in front of the existing bridge abutments to support the steel girders. One month cure time would be required for the concrete. It is estimated that total construction time would be 2½ months and removal time would be 2 weeks. During construction, an identical bridge 1.2 miles South could be used for access to the West side of the river.

Opinion of Costs

Based on these preliminary evaluations, the estimated project costs for modifying the existing steel truss bridge are as follows:

Construction			
	Concrete	$20,000	
	Steel	40,000	
	Shop Fabrication	10,000	
	Erection	10,000	
	Decking	30,000	
		SUBTOTAL	$110,000
Removal			10,000
		SUBTOTAL	$120,000

Contingency	$ 18,000
Engineering Design (preliminary & final)	14,000
Engineering Services During Construction	10,000
Administration (permiting, legal, etc.)	4,000
Estimated Total Project Cost Truss Bridge Modifications	$166,000

NEW BRIDGE

Removing the existing bridge and constructing a new bridge would be a major improvement over the existing crossings in the immediate area. For this report, the existing road alignment would be maintained although analysis may show that another alignment is more desireable. The existing truss bridge including concrete abutments would be removed. A new bridge would span 200 feet and would be 30 feet wide. The existing bridge would be two lane with a walkway. This alternative would include reconstruction of approaches, concrete abutments, steel girder framework and a concrete deck.

Constructability

Since a bridge 1.2 miles to the South could be used for access, removing the existing bridge would not present a problem. Most of the construction work could be done without interference with the river flow. And, little environmental impact would be experienced. Concrete cure time would extend the time of construction. For removal and construction, it is estimated that 4 months time will be required. In addition, construction should be performed during the low flow periods,

Opinion of Costs

Removal			
	Bridge	$10,000	
	Concrete	5,000	
	SUBTOTAL		$ 15,000
Construction			
	Concrete Abutments	$50,000	
	Concrete Deck	95,000	
	Steel Framework	180,000	
	Approaches	5,000	
	SUBTOTAL		330,000
	SUBTOTAL		$345,000

Contingency	$ 52,000
Engineering Design (preliminary & final)	40,000
Engineering Services During Construction	28,000
Administration (permiting, legal, etc.)	5,000
Estimated Project Costs New Bridge	$470,000

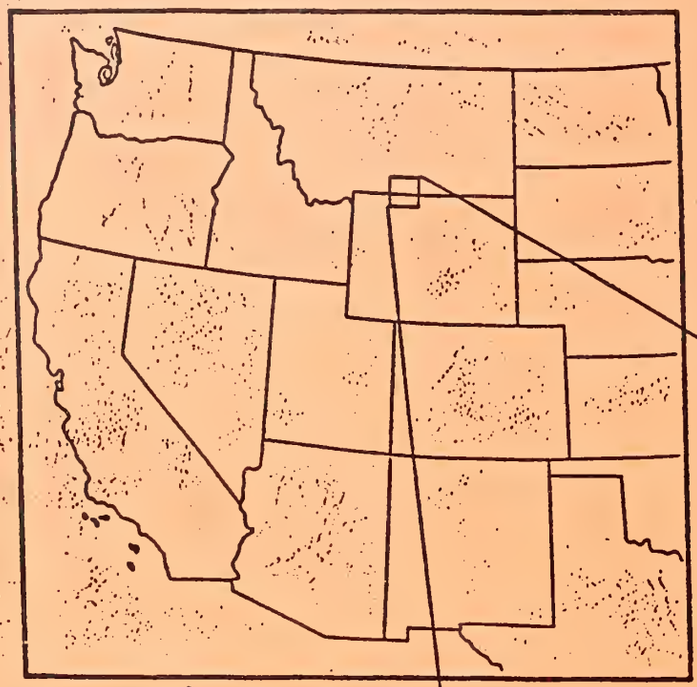
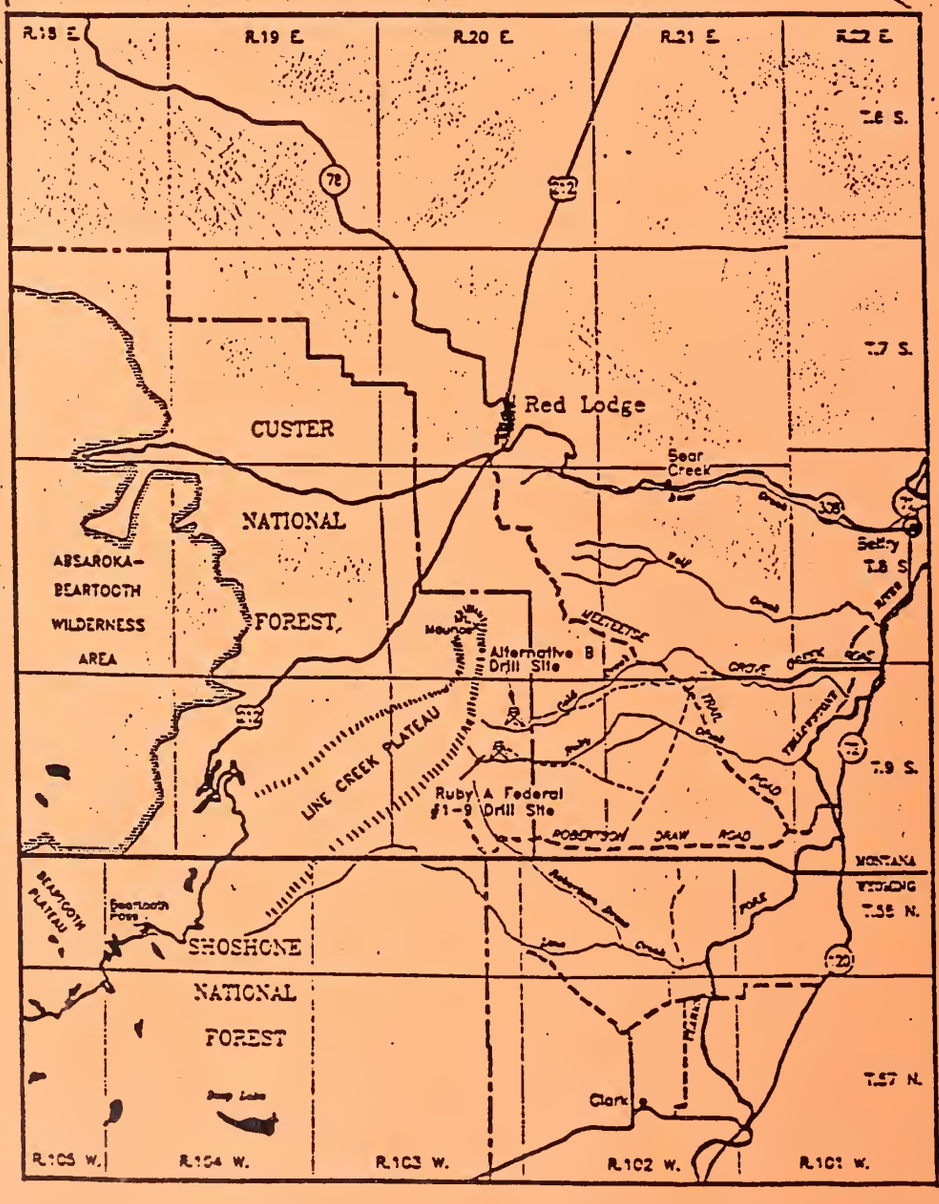
IV RECOMMENDED PLAN

Based on the outline cost estimates, modifying the existing structure is the most desirable alternative. The project costs of the modifications are $166,000 compared to $470,000 for a new bridge.

It should be noted that nodifying the existing bridge is a temporary measure to meet the short term needs of the exploratory well. A new bridge would be a more permenant solution that would meet the well needs as well as future needs.

Ease of construction of the bridge modification would be greater than a new bridge. And, the construction time is less. Given the summer of 1989 to construct the exploratory well, it would be very difficult to construct a new bridge at this late date.

If the Southern access route is selected as the access route to the well site, we recommend modifying the existing steel truss bridge.



Applicant: Phillips Petroleum Company